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THE AMERICAN GAS LIGHT JOURNAL

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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

Twenty-second Annual Meeting, Western Gas Association.

WESTERN GAS ASSOCIATION, OFFICE OF THE SECRETARY,
NEW ALBANY, IND., May 10, 1899.

To the Members of the Western Gas Association:

The twenty-second annual meeting of the Western Gas Association will be held in Milwaukee, Wis., June 14, 15 and 16, 1899.

The meeting will be called to order by the President, Mr. George Treadway Thompson, at 9:30 A.M., Wednesday, June 14.

Mr. E. G. Cowdery, Chairman of the Committee of Arrangements, reports that the Hotel Pfister has been selected as headquarters, and that the meetings will be held in its banquet room.

Arrangements for the entertainment of the guests are not as yet wholly completed. Those that have been determined upon are as follows:

A reception to the gentlemen and ladies present will be given by Mr. Cowdery at his residence on Wednesday evening.

A banquet, to be provided by the Association, in which the ladies will participate, will be held on Thursday evening in the main dining room of the Hotel Pfister. Several novel features will be introduced on this occasion, which will, it is believed, add very materially to the entertainment of guests, and it is urged that members do not fail to provide themselves with tickets in advance.

Tickets for banquet will be sold at $5 each, and will entitle the holder to all privileges of the excursion which will be provided for Friday.

As it is necessary that arrangements for this banquet and excursion should be perfected at a very early date, it is requested that all those who expect to attend the meeting will purchase their tickets, or notify the Committee as early as possible of the number of tickets they will require.

The gas works, the E. P. Allis works, the breweries and other places of interest, all of which will be easily accessible by electric cars, will be open to the inspection of visitors during the week. A list of such places will be made up, with directions for finding same easily.

Accommodations can be secured at the following first-class hotels, all within five minutes' walk of the Pfister:

Hotel.	American Plan.	European Plan.
Hotel Pfister	$3.00 to $5.00	$1.50 to $3.50
Plankinton House	3.50 to 5.00	2.50 to 3.50
Hotel Davidson	....	2.50 to 3.50
St. Charles Hotel	2.00 to 3.00	....
Schlitz Hotel	....	1.00 to 1.50
Hotel Blatz	....	2.00 to 5.00

The Executive Committee has arranged for the presentation of the following papers:

"Causes Underlying the Formation of Naphthalene and their Prevention," by Mr. Paul Doty, Grand Rapids, Mich.

"Vitrified Clay Pipes Instead of Iron for Gas Mains," by Mr. Irvin Butterworth, Columbus, O.

"Furnishing Gas at Higher Pressure and without Leakage," by Mr. F. H. Shelton, Philadelphia, Pa.

"A Foundation That Failed and the Lesson It Taught," by Mr. B. E. Chollar, St. Louis, Mo.

"Cyanides in the Gas and Waste Products at Columbus, O.," by Mr. E. E. Eysenbath, Columbus, O.

"Problems in New Business: Some History and Experiments," by Mr. F. B. Wheeler, Binghamton, N. Y.

"Wrinkle Department," edited by Mr. E. H. Jenkins, Buffalo, N.Y.

"Report of Committee on Isolated Generators for Bench Firing," by Messrs. F. Bredel, Irvin Butterworth and W. E. Steinwedell, Committee.

The Western Passenger Association, from points in Eastern and Trans-Missouri territories, the Central Passenger Association, Trunk Line Association, Southeastern Passenger Association, the Wisconsin Central Lines, Chicago, Rock Island and Pacific Railway Company, the Chicago and Alton Road, have granted rates of one and one-third

fare for the round trip, conditional on 100 certificates being presented to the Secretary for indorsement. The territory embraced by the above Associations includes all States east of the Mississippi River, except New England. The following States and Territories west of the Mississippi River are in the territory covered by the railway associations granting reduction: North Dakota, South Dakota, Minnesota, Iowa, Missouri, Nebraska, Kansas, Oklahoma, Indian Territory, Colorado and Utah.

All persons attending the meeting will purchase a first class ticket at starting point, paying full fare for same, obtaining from agent a certificate stating that the person whose signature appears on same has purchased, at full tariff fare, one first class ticket to Milwaukee, which certificate, after it has been signed by the Secretary of the Association and a representative of the above Passenger Association, will entitle the purchaser to a one-third rate returning home.

Apply to ticket agent at least 30 minutes before departure of train. All station agents do not have a supply of certificates, but they can be obtained by request, if notification is made in time. Persons outside the territory embraced by the Passenger Associations mentioned above should purchase a ticket to nearest point within one of said Association, and from there purchase a ticket to Milwaukee, obtaining a certificate which will, if properly endorsed in Milwaukee, entitle them to a one-third fare returning to place from which certificate was obtained, provided it is endorsed by a representative of the Passenger Associations, who will be present at the meeting, and the undersigned.

Those who live in Western Passenger Association territory should consult local agents several days in advance of purchasing ticket to Milwaukee, in order to reach an understanding with the different roads as to the junction point via which they will make rates applicable. Some local agents sell to junction points, where delegates can rebuy to destination. Certificates held by wives of the delegates attending the meeting will be honored in the same manner as those held by the delegates themselves.

All queries sent the Secretary for the "Question Box" will be assigned to members for answers.

Mr. E. G. Pratt, of Des Moines, Iowa, is Chairman of the Committee on Extension of Membership, from whom, as well as any of the local committeemen, blank applications for membership can be obtained.

The Secretary will be pleased to answer any communication pertaining to the meeting, and will mail blank applications to any who desire to become members of the Association.

JAMES W. DUNBAR,
Secretary.

BRIEFLY TOLD.

OBITUARY NOTE: JOSEPH PEARSON GILL.—In our issue for January 16th, 1899, was given brief mention of the death of Mr. Joseph Pearson Gill, who passed away at his home in this city the morning of January 9th. At the time of printing the fact of his death we promised to give a short history of his career, for such would be the record of a man who had been prominent in gas engineering circles for almost a half century. Considerable difficulty was experienced in collecting the data, and that difficulty is the explanation of the delay in publishing the record of his life, which is here given as succinctly as possible. Joseph Pearson Gill was born in Philadelphia, Pa., June 21st, 1821, where his education was subsequently completed. In 1843 he entered the service of the United States Navy, serving through the Mexican War, and retiring from such service with the rank of Assistant Paymaster—he was on the frigate "Savannah," which vessel played a prominent part in the taking of Monterey. Returning to Philadelphia, he took up the studying of civil engineering, and upon his obtaining a certificate of proficiency he engaged in the active pursuit of his profession, first at railroad construction and subsequently in the building of gas works. In 1850 Mr. A. H. Vancluse obtained the contract for the construction of the Richmond (Va.) works, and the engineer in charge of the building was Mr. Gill. In 1851 the plant of the Petersburg (Va.) Gas Light Company was completed under his supervision. In 1852 he was concerned in the building of the Jersey City (N. J.) Gas Light Company's plant. In 1853 he went to East Boston, Mass., from which place he was sent by a firm of contractors to look over the State of Maine for eligible places wherein to locate gas plants. The result of his reports was that in the following year plants were erected in Lewiston, Augusta, Bangor and Bath, all being constructed under his immediate direction. He accepted the superintendency of the Lewiston works, and there he remained until 1873. The rigors of the Maine climate finally obliged him to seek a milder atmosphere, and in the spring of 1873 he accepted the engineering charge of the plant of the Citizens Gas Light Company, of Newark, N. J., which was then in a pretty poor way. Differences as to the policy of the Company, between its then President (Mr. Smalley) and himself eventually caused his resignation, and for several years thereafter he was occupied in one way or another with the gas interests of this city—at one time he was associated with the late W. H. Grenelle in the introduction of the Gibson valve, the purpose of which was to prevent the formation of hard carbon in retorts by doing away with the ordinary dip-pipe seal. Towards the close of his life (perhaps for the last decade thereof) he was not actively identified with the industry, save in that he was a frequent contributor of valuable articles to our columns. In October, 1874, he was present at the second annual meeting of the American Gas Light Association (Polytechnic Institute, Brooklyn, N. Y.), as the representative of the Citizens Gas Light Company, of Newark, N. J., but he did not keep up his affiliation with that body. He was married November 17, 1862, to Miss Carrie J. Blaisdell, of Auburn, Maine, who survives him, as does a son. He was interred in Kensico Cemetery, Kensico, N. Y. Deceased was a studious, methodical, conservative engineer, and the only reason that prevented him from taking higher rank, in a public sense, in his profession was a remarkable natural timidity. We say in a public sense only from our knowledge that his engineering practice was in every way sound and commendable, and of profit to his employers. Personally he was the mildest of men, but neither his timidity nor his mildness could cause any to sway him from the path that he held was the road over which honor trod.

NOTES.—To day the proprietors of the Union Gas Company and of the McKeesport Fuel Company, of McKeesport, Pa., will vote upon a proposition to consolidate their interests.——We regret to report the death of Mr. William R. Down, youngest son of the late Mr. William H. Down, of the American Meter Company. His demise occurred, at his home in this city, the morning of June 1st.——At the May meeting of the Board of Directors of the Malden and Melrose (Mass.) Gas Light Company it was voted to reduce the price of gas to $1.30 per 1,000 cubic feet, the concession to date from the 1st prox. This reduction is noteworthy in that it is the third made by the Company in as many years, and is an earnest that, if the residents of Malden and Melrose will support the proprietors in their efforts, dollar gas there is but a question of short time. Mr. Thomas H. Hintze, the Company's wideawake Superintendent, is quite elated over the rapidity with which gas stoves are being put in use.——Under the change of proprietorship in the Clearfield (Pa.) Gas Company the following Directors were chosen: A. F. Boynton, J. B. Nevling, Alexander Patterson and T. J. Patchell. Mr. J. B. Nevling succeeds Mr. George S. Hughes as Superintendent and Manager.

Correspondence

[The JOURNAL is not responsible for the opinions expressed by correspondents.]

Benzole and Its Value.

BARRETT MFG. CO., CHEMICAL DEPT.,
PHILA., PA., June 1, 1899.

To the Editors AMERICAN GAS LIGHT JOURNAL: In the issue of your valuable JOURNAL, dated May 22d, is an interesting letter on the subject of coke ovens, giving an estimate, by Mr. J. Young, on the value of the products obtained from such ovens. As the figures date from 1891, of course the value placed on some of the products, especially of tar and benzole, does not apply at this time owing to the great decline in these articles; but the object of this note is to call attention to an error, not only in Mr. Young's but in nearly all published estimates as to the value of benzole. In this case the yield is figured at one gallon per ton of coal carbonized, and the value at 50 cents per gallon.

This yield is in itself remarkably large, but even if it can be obtained the one gallon would not be a refined benzole worth 50 cents per gallon. In fact, on the contrary, it would be a crude article, of dark color, mixed with heavy naphtha, naphthalene and some creosote oil, requiring much refining. It must be distilled, treated with acids and soda and refined in column stills. The refined benzole would not exceed 50 per cent. of the original material.

In all estimates on this subject that have come under my notice no account has been taken of this loss, nor of the cost of the labor, steam and chemicals used; and in figuring on the total value of the plant the very expensive benzole refinery is in all cases omitted. Crude benzoles obtained from coke oven gases can be bought in Europe at the present time at about the price of creosote oil.

Respectfully yours, H. N. JAYNE.

[Written for the JOURNAL.—Concluded from Page 804.]

Large Gasholders in England.—No. III.

By Mr. NORTON H. HUMPHRYS, C.E., F.C.S.

A gasholder erected at Fulham, London, at a works now belonging to the Gas Light and Coke Company, in 1867, from the designs of Mr. F. V. Kirkham, is worthy of notice as a brave attempt to give a pleasing and artistic appearance to a large gasholder. In this respect I think Mr. Kirkham stands alone, the general feature in connection with large holders being a strict attention to utility with regard to economy in design. It is also worthy of notice that extra expenditure was not incurred to a large extent, as the cost of the holder and tank complete was £67,000, or about £26 per 1,000 cubic feet of capacity, which was at that period a very moderate price. The tank was built of brick, in alternate rings of 3 feet in Portland cement and 5 feet in hydraulic mortar, and was 232 feet in diameter and 33 feet deep. The footings were set out 5 feet 6 inches wide, from which the wall was carried up 10 feet, four bricks thick, 7 feet, 3½ bricks, 7 feet, 3 bricks, and 7 feet, 2½ bricks. The holder was 2 lift, 230 feet 6 inches and 228 feet diameter, respectively, by 32 feet 6 inches deep. The columns were 28 in number, and comprised moulded and fluted pedestals, fluted shafts, Corinthian capitals, in all 55 feet high, above which was a square entablature 9 feet high surmounted by an ornamental cover or cap. The entablatures were connected together by open work girders constructed of wrought and cast iron, consisting of a strong horizontal top member and an arched bottom member with ornamental tracery between the whole, presenting a very elegant and artistic appearance. Guide rails of tee-section were fixed clear of the shaft by connections at 5 feet intervals, and the wheels were double flanged and radial. In many respects this holder retained some of the old traditions, and a noticeable feature was the shallowness of the lifts, the height being one-ninth of the diameter.

The twin gasholders, constructed at Winsor street, Birmingham, from the designs of Mr. Charles Hunt, present many striking features. For some years I believe they had the honor of being the largest in England. The tanks were 240 feet diameter and 51 feet deep. The walls and piers were built of brick, concrete being used for foundations, rest blocks and covering the cones. Hoop iron bonds, one for each brick in thickness, were built in every six courses, and the first 10 feet above the footings was built in cement. Above this eight courses at 8 feet intervals were laid in cement, and the remainder in blue lias lime mortar. A great deal of trouble was experienced in getting out the foundations, by the presence of large quantities of water, and at one time there appeared to be little chance of getting down to the full depth. The means by which this difficulty was grappled with and successfully conquered affords interesting reading. Short lengths only were excavated at one time, a double floor of elm planking laid, and 2 feet thickness of concrete put on as rapidly as possible. No puddle was used, a rendering of equal parts of Portland cement and sand ½ inch thick, with a second coat of neat cement ¼ inch thick, being relied upon to keep the tank sound. In view of the unstable nature of the ground the backing behind the walls for the first 21 feet in height was composed entirely of lime concrete. Above this sand and loam were used, well rammed in thin layers. Much of the "spoil" was utterly unfit for backing, as it became soft and spongy when rammed, and much difficulty arose in curving the bottoms, as the slope of cones could not be steeper than 3 : 1, on account of the nature of the soil. The thickness of the walls for the first 22 feet 6 inches above the footings was 6 bricks, above which it was reduced, at 4 feet intervals, 2½ bricks at the top edge. There were 26 piers, each 7 feet square, for supporting the colums, and the wall was also strengthened by intermediate piers in which the thickness of six bricks was maintained right up to the curb, a system very generally adopted in brick tanks of large diameter.

Each holder includes three lifts, 236, 233 and 230 feet diameter respectively, and each 50 feet deep, representing a storage capacity of something like 6,000,000 cubic feet per holder, or a total of 12,000,000. The sheeting includes vertical stiffeners opposite each column, and also at intermediate points, and the sheets next the curbs, cups and grips are of ½-inch plate, and long enough to reach from one stiffener to another without join. The remaining sheets are of 10 B. W. G., and 6 feet 6 inches long by 3 feet 3 inches wide. All the grips and cups are of the shape known as Piggott's, and are each 12 inches wide, 18 inches deep, and formed of $\frac{7}{16}$-inch plate. All joints in the curbs are made to butt and secured by covering plates and strips, there being no space between the joints. The effect of this was to give great rigidity, and no appreciable deflection, whatever the position of the holder. Both radial and tangential rollers and carriages are used. The top curb consisted of ⅝-inch steel plates, 3 feet wide on top and 14 inches wide on side, double riveted to a 6-inch by 6-inch obtuse steel angle, and the side plate is further stiffened by a 5-inch by 3-inch steel angle. The bottom curb is of $\frac{7}{16}$-inch steel plate, with two 9-inch by 3½-inch by $\frac{7}{16}$-inch steel angles riveted to it, 15 inches apart. The crowns have a rise of 20 feet. The guide framing is of special design. The standards comprise front and back members, of circular form, 1 foot inside diameter, made up of four sections of channel iron, with external vertical flanges. At the base they are 5 feet apart center to center, and while the front member is upright, the back member is raked so that they meet at the top, and are secured to each other and the top row of girders by a cover plate. They are joined by cast iron struts, 7 feet 6 inches apart, with intermediate flat bracing of 4 inch by ½-inch iron, and are secured to a heavy cast iron base by means of gusset plates. The bases are fastened to the piers by four 2¼-inch bolts 14 feet long, which are built in after the usual manner. The guide for rollers consists of 8-inch by 5-inch joists secured to the standards by wrought iron brackets, and each column rises 151 feet. There are four horizontal tiers of girders, exclusive of the top row, at 30 feet intervals. Each girder is formed of two lengths of 6 inch by 5-inch rolled joist extending from back to front member, and from front to back member of the standards respectively, and crossing each other at the center. They are stiffened by cross bracing at each end. The cross bracing was double, that is, two crosses one above the other in each bay, and secured to the back members of the standards. The holders were placed so near to each other that one standard was common to each, and in this case the front and back members are parallel. The top row of girders is of half box pattern, the sides formed of two lengths of 9¾-inch by $3\frac{3}{16}$-inch channel iron, and there is a top plate $\frac{5}{16}$ inch thick, and cast iron distance pieces at the bottom, at 4-foot intervals. A double hand rail is attached so that the top plate forms a foot walk continuous round the holder.

A holder of somewhat similar size to one of Mr. Hunt's was erected at Glasgow in 1892, and although coming somewhat outside the title of "Large Gasholders in England," some notice of it may be inserted here. The tank was 240 feet diameter by 46 feet deep, involving the excavation of 90,000 cubic yards of material, the greater portion of which was rock, and the putting in of 20,000 cubic yards of building material and puddle. The holder was made entirely of steel and comprised three lifts, with a total rise of 135 feet, and a capacity of 6,000,000 cubic feet. The side walls of the tank were built of brick, in Portland cement mortar, in the proportion of one of cement to two of sand. Two feet thickness of puddle was put in behind the walls, which were very strong, being 7 feet 9 inches thick at the base, diminished to 4 feet 6 inches thick at the top by three offsets. The bottom was covered with 15 inches of puddle overlaid by concrete 6 inches thick. The standards, 26 in number, somewhat resemble the Birmingham holders in having one upright front member and one raking back member, joined by struts and cross bracing. There were three rows of cross girders, the two lower being composed of two lattice girders braced together by diagonal bars so as to form a box girder, and the top row was of single girders only. The frame is further strengthened by diagonal bracing of flat bars, two pairs, one above the other in each bay, and attached to the front member of the uprights. The holder is guided by radial rollers only, working in guides of channel iron.

I propose to conclude this paper by a description of the largest gasholder in the world, the design for which is attributable to the genius of Messrs. George and Frank Livesey. A complete record of the development of the gasholder system at the plant of the South Metropolitan Gas Works would of itself furnish a fairly complete history on the general question. For no one has attacked the important subject of cheap storage with more energy, or achieved more success than the gentlemen just named. And the latest development is, as already remarked, not only the largest but also the cheapest holder in the world. The site selected was surrounded on three sides by a bend of the river Thames, and consisted of a deep layer of loose gravel, covered with 6 or 8 feet of peat and a thin layer of clay on the top. Obviously an excavation could not be carried, except at very great expense, below the water line of the river, so it was decided that the tank should be 34 feet deep, just deep enough into the gravel to get a good foundation and standing 21 feet above ground level. The diameter was 300 feet, and the walls were built of concrete, consisting of one part Portland cement to 8 of Thames ballast, clinker, broken retort and brick, with flat iron, bands inserted at every 2 feet in height. These bands were of flat iron 5 inch by ⅝ inch thick, riveted up into complete rings all round. The mixture of ballast with clinker and brick was not merely a question of

price, but the rough and irregular surface of the clinker was considered to give an advantage over the rounded pebbles in the ballast and to form a better material. The wall was 5 feet thick for the first 12 feet, the excavation being cut only just large enough, so that no backing was required, and then diminished to 3 feet 6 inches thick at the top. Nearly the whole of the center was removed, being available to form the embankment above ground level, and the bottom was covered with 12 inches of concrete. The sizes of the six lifts were, respectively, 300 feet by 31 feet; 297 feet 6 inches by 31 feet 3 inches; 295 feet by 31 feet 6 inches; 292 feet 6 inches by 32 feet; 290 feet by 32 feet; and 287 feet 6 inches by 31 feet. The working capacity of the holder is 12¼ million cubic feet. One difficulty was that of resting the rollers and carriages, and that was met by arranging them alternately radial and angular, and the bottom of the first or inner lift was fitted with tangential and radial rollers. A special feature is that the external guide framing is only continued two-thirds of the height, so that the first and second lifts rise clear above it when the holder is full. These two lifts, therefore, required unusually strong vertical stays. These are 64 in number in the first lifts and are composed of semi-circular plates, 12 inches by 12 inches, made of No. 10 B.W.G., and the second lift has 128 stays, 64 half round and 64 of channel iron, 7 inches by 3 inches by ½ inch.

The vertical stays in the other lifts are of channel iron of similar section, 64 in each, and form the roller paths. The crown rises 25 feet in the center, and is covered with steel plates weighing 5.7 pounds per square foot. The sheets adjoining the curb are very strong. The outer row of sheets is made of 1-inch steel plates 42 inches wide, the next of ½-inch iron, 24 inches wide, and the third of ½-inch iron, 24 inches wide. On the side there is a row of 12-inch by 1-inch steel plates, and 12 inch by ½-inch iron, and the curb is formed of 6-inch by 6 inch by 1 inch steel angle, with a second ring of 6-inch by 4-inch by 1 inch angle. There are 32 upright standards of H-section, 30 inches deep at the base, tapering to 22½ inches at the top, and 126 feet high; and there is no horizontal attachment except a strong box girder, 2 feet square in section at the top, the upper member of which forms a footway round the top. Strong diagonal bracing of T-section is used, commencing with 12 inch by 12-inch by ½-inch at the bottom, and reduced to 8 inch by 10-inch by ⅜-inch at the top, and there are five pairs of diagonals in each bay. The inner lift of this holder only gives 29 tenths pressure, which is not sufficient for the requirements of the district. When it is to be emptied the contents are pumped into a heavier holder. The full pressure when all six lifts are up is only 70-tenths.

[Written for the JOURNAL.]

The By-Product Coke Oven for the Manufacture of Illuminating Gas.

By MR. HENRY W. TRUE, Halifax, N. S.

The successful coke oven for the manufacture of metallurgical coke with the saving of by-products dates from 1862. Since that time it has been greatly improved, the object of each improvement being the quality of coke. Very few of these early ovens produced surplus gas over that required to maintain the heats. The little saved was of poor quality and consumed as fuel under boilers. At several places in France and Germany a part of the surplus gas was used for illuminating purposes, and at one place an attempt was made to light the town with the surplus gas from the coke works. At the present time there are many different designs of coke ovens, all making good coke for metallurgical purposes and having a surplus of gas over that required to maintain their heats of from 20 to 40 per cent., depending in a great measure on the composition of the coal used.

In June of last year the Peoples Heat and Light Company, of Halifax, N. S., after many costly experiments, commenced the manufacture of all its illuminating gas in a block of 10 by-product coke ovens, letting down the retorts, this being, as far as we are able to discover, the first time in the history of gas works that the by-product oven had been used for that purpose.

The ovens, which are of the horizontal, tiled flue type, are 30 feet long and 6 feet high, and have an average width of 17½ inches. They have three charging holes on top, and a door at each end the full size of the oven. They take a charge of 5 net tons of coal from cars running overhead. A steam ram runs on a track on one side of the ovens by means of which the coke is discharged, falling into a car at the other side. The car has an inclined bottom and moves slowly along as the discharged coke falls into it. This distributes the coke to an even depth. It is quenched as it falls into the car.

Very little attempt has been made at regeneration in these ovens, as in so small an installation the saving would not warrant the extra expense. The air is preheated to a temperature of 400° F., by passing through air passages underneath the flue that carries the spent gases from each oven to the stack. We also get part of our steam from the spent gases passing under the boilers.

The ovens are provided with two hydraulic mains. The gas for the first 8 or 10 hours is collected in one of these, put through the ordinary operation of condensing, washing, purifying, etc., and distributed. The rest of the gas is collected in the second main, the tar and ammonia removed, and the gas used to heat the ovens. The heats maintained are about the same as with the half-depth, regenerative retort setting. The yield of coke with the same coal is from 4 to 7 per cent. greater than with the retorts; that of tar and ammonia about the same as with retorts, and the yield of gas some less. The Company as yet only recovers the tar and ammonia, but our experiments show that the sulphur can be recovered quite cheaply. We also experimented in a small way with the recovery of cyanogen, but so far we are led to believe that it would only be profitable in large works. Our coke is used in place of anthracite coal for all purposes. The tar is sold in the wells to a separate concern that operates a manufactory on the gas works property, making roofing felts, asphalt, etc.; also creosote oil and pitch. Our ammoniacal liquor is concentrated to about 18 oz. strength and shipped in tank cars.

From the 12th of July, 1898, to May 1st of the present year, we carbonized in our ovens 14,700 tons of coal, of which about 8,000 tons was slack of a good steam coal, half being washed, 2,000 tons run of mine gas coal, 2,000 tons slack from gas coal, and the rest various kinds of slack, including bank slack several years old, etc. The yield of gas from the above was 129,000,000 cubic feet, of which 81,000,000, or 63 41 per cent., was consumed under the ovens, and 47,200,000, or 36.59 per cent., distributed. The average yield per ton of coal carbonized was 8,775.5 cubic feet.

The months of September and October gave us 42 per cent. surplus gas with gas coal; December the lowest, with but 28 per cent. surplus, principally on account of a dry steam coal, and somewhat from the fact that it requires more gas to heat the ovens in cold weather. Our ovens are roofed over, but somewhat exposed on the sides. The illuminating value of the above gas varied directly with the kind of coal used. With gas coal from the International mine of the Dominion Coal Company, which is one of the best in the world, the yield would be near 10,000 feet, and the candle power of the surplus gas 18. With bank slack the yield went down to 6,000 feet; and the candle power of the surplus gas to 8. We separate the surplus gas for distribution. The first part is sent out through one set of mains for illuminating purposes, the second part, amounting to 36 per cent. of that sold, being distributed through a second set of mains for fuel purposes. Unfortunately we kept no accurate record of the illuminating and heating values for the whole period, but the daily record for four months shows the first part to average 17.64 candles, and to have a calorific value of 658 B.T.U.; the second part 11.49 candles and 592 B.T.U.

Aside from the management of the ovens the process is the same as an ordinary coal gas works. Some little care has to be used to keep uniform pressure on the ovens, and if coals high in sulphur are used, lime purification to remove the sulphur compounds will have to be resorted to, although we are having fair success in removing the sulphur compounds by washing our gas for distribution with liquor from the hydraulic main. There are no new engineering features in the by-product coke oven for the manufacture of illuminating gas. The problem is purely a commercial one and consists in marketing at a profit the extra quantity of coke, tar and ammonia.

The coke is an excellent substitute for anthracite coal for every purpose, being smokeless, much cleaner to handle and giving intense heat. We have proved by many trials under all conditions that ton for ton it will go just as far. It requires some different treatment, however, and never should be sent out without an experienced man going with it to teach its use. The 24-hour coke made in an oven making illuminating gas is not of itself strong enough to support the charge in a blast furnace, but greatly improves the operation of a blast furnace when it is mixed half-and-half with beehive coke. Smaller foundries find it excellent for their purpose. It is safe to say that a market can be made for it in any locality at $1 per ton less than anthracite coal, as some concession must be made to induce the public to try a new fuel. We have sold 75 per cent. of our coke this first year in competition with anthracite coal, with some times but 25 cents per ton difference in price. The tar in many instances would be a drug, but if it cannot be sold it can be burned to maintain the heats in the

ovens, and worked up into briquettes with coke and breeze. There seems to be a ready sale for any amount of ammonia at a fair profit. It can also be made into sulphate at slight expense, and if quite a distance from a market a local market can be created for the sulphate for fertilizing purposes. The sulphur is recoverable in quite a pure state at small expense.

The cost of labor is low with ovens. Running 10 ovens to their capacity of 50 net tons of coal per day, it can be handled for 50 cents per ton, including taking the coal from the pocket, crushing and storing the coke, putting the purified surplus gas in the holder, the tar in the wells and concentrating the liquor to 18 per cent. of ammonia. In the case of a coal very high in sulphur, requiring lime purification for sulphur compounds other than sulphureted hydrogen, the cost would be increased by 2½ cents per 1,000 on a yearly make of 40,000,000. This item would be about evenly divided between labor and small coke at cost, as a large part of the lime would be used over many times by a process of reburning in kilns. The initial cost would be greater by double the cost of purifying plant. After running these ovens nearly a year we see many little details that can be improved and many ways in which much better results can be obtained. We feel that under the circumstances the first application of the by-product oven for the manufacture of illumination gas has been a success, and it seems as if there was a future for them for this purpose. The by-product oven costs about twice as much per 1,000 feet of gas distributed as the half-depth, regenerative retort setting, but while the retort will last but three years or four at the outside the oven will run three times as long. There are ovens in use at present that have been running with but slight repairs for 12 years. While the greatest care should be exercised in bringing a block of ovens to a heat in the first instance, they can afterwards be laid off and started up without injury. We allow about two weeks to let one down. They can be brought to a heat in 24 hours. They can be charged light or full, and can be run easy or forced. The width should be such as to coke the kind of coal they are intended to use in 24 hours, especially in a small installation where the chargers would have other work as well as charging ovens. Five men and a foreman draw and charge two ovens per hour. On a pinch they can be forced to burn off a charge in 18 hours, at the expense to a certain extent of the quality of the coke. The great value of the oven for gas manufacture is its ability to use the cheapest kinds of coal.

Gas coal slack makes good gas and fine coke. If very dirty, and the coke intended for foundry use, the slack should be washed. Bank slack makes a coke of rather poor appearance, but good heating value. The quantity of gas would be small and require considerable enriching. The selection of a coal for ovens depends of course on the cost of the different coals as laid down at the works and the cost of enriching. Some coals that could not be used in retorts would be excellent for ovens.

The writer has purposely avoided any reference to the technical side of the oven question intending to make it the basis of another article.

The Science and Art of Selling Gas.

[A paper read by MR. THOS. D. MILLER, of Dallas, Tex., at the Austin Meeting of the Southwestern Gas, Electric and Street Railway Association.]

"Good sense, which only is the gift of Heaven,
And though no science, fairly worth the seven."—POPE.

Science is knowledge; art is skill in using it. Perhaps the most difficult task to perform is to draw a sharp distinction between two such synonyms as science and art.

Now, the manly art of self-defense is commonly called science, and, be it either or both, history records that it has its utility in the science and art of selling gas—this is only illustrative of the possibilities of this subject.

Science is a classification of knowledge from which certain results can be foretold with given conditions.

The science of selling gas will go back to the coal pile, for it is almost axiomatic that to succeed in selling gas an article of good and uniform quality must be offered. The question of uniform quality of gas is one that involves every process in the manufacture and distribution of the gas as well as the quality of coal used. After once determining the relative values of the different coals obtainable it is no great problem to settle which coal is best to use. This should be done at the separate plants, for observation has shown that the results in one plant will not always be confirmed in another. This is probably due to different apparatus and methods of working. The different processes of scrubbing and condensing and extracting the tar very materially affect the candle power.

It is obviously undesirable to furnish gas having an excess of sulphur or ammonia, the result of which is the rapid deterioration of apparatus, from the purifying boxes to the consumers' burners, destruction of station meters, consumers meters, service cocks, fixtures and burners, causing no end of complaints of poor lights, tight keys and stopped services. Nothwithstanding this, plants have been run for years with inadequate purification and all its accompanying evils. With a popular competitor in the field crude methods must be abandoned or defeat is sure to follow.

When coal gas passes from the retort into the ascension pipe it is charged with coal tar, sulphur, ammonia and carbonic acid, in varying proportions, all of which it is desirable to get rid of as speedily as possible, and yet not extract the illuminants and other valuable constituents. For instance, a sudden reduction of temperature of the gas will carry down, by condensation, tar, moisture and naphthalene. This latter is a valuable illuminant, but a troublesome thing to have dropping down in apparatus and pipes.

Having placed a good quality of gas in the holder an adequate system of mains, services and meters is necessary to the exercise of the art of selling gas.

In the conduct of any business, and particularly so with an enterprise having dealings with a great many people in one community, a well settled policy is absolutely necessary; one that has been carefully considered, thoroughly outlined and must be reasonably executed. Under such conditions complications are avoided in the dealings with customers, and consequently the good will of all is more easily retained.

It is the popular thing for everyone to abuse the gas company, but the man who sells the gas should see to it that not one of his customers can name a single instance where he has been unfair or arbitrary. He should bear in mind that much about the gas business is, to the public mind and eye, mysterious, and not lose an opportunity to enlighten a consumer on any point where there seemed to be a lack of understanding. Give all to understand that there is nothing about the business that anyone may not know, and by living up to such a policy you will establish confidence in your management. Having done this you have accomplished the first step to the end sought.

Many of the prejudices existing to-day against gas companies are directly attributable to methods long since abandoned, and which exist to-day only in history. Gas companies have in the past made enormous profits, and this fact having become known the belief is deep rooted to-day that the profits of the business are just as great. As a matter of fact, however, the earnings of the gas companies throughout the country show only a legitimate return on the investment; and that, too, a small return as compared with other manufacturing plants.

It is not the purpose of this paper to go into details of methods to be adopted in the practice of the art of selling gas, about which so much has already been written by more competent pens.

The following stock will aid in the sale of gas:

Always be courteous to everyone whether a consumer or not. Always give prompt attention to complaints and be prepared to give satisfactory explanations for causes of trouble. Always collect bills promptly and keep your eyes open for new business. Always keep posted on everything that is new, whether good, bad or indifferent, for it is worth just as much to know what not to attempt as what to do. Always encourage consumers to make complaints, for if they don't complain you have no way of knowing they are dissatisfied, and a disgruntled consumer will hurt you worse than a grumbling ex-consumer. Always be pleasant with the drummer, for he will be so with you if you let him. Always tell the truth, or no hing.

In conclusion, your pardon is humbly craved for this Sunday school lesson, which you have all learned years ago; but in granting it you must admit the desirability, if not the practicability, of a strict compliance with the principles referred to.

Notes on Modern Systems of Retort Heating.

[A paper read by MR. G. P. LEWIS, of Lower Sydenham, at the last Meeting of the English Institution of Gas Engineers.]

The several advantages claimed for the use of gaseous fuel in retort settings are now almost universally conceded, and indeed its employment is absolutely essential to the success of the "inclined" system. It would therefore be only waste of time to reiterate the arguments adduced in support of its value for such a purpose. There is, however,

still considerable divergence of opinion in regard to the value of recuperation, the use of steam under generators, etc. The author has therefore limited this communication to the consideration of such points as form the subject of debate at the present time, with the hope that the suggestions set forth will lead to a useful discussion.

RECUPERATORS.

Classification.—For convenience of comparison, recuperators may be grouped into three classes, according to the degree of recuperation attempted.

Class.	Designation.	Characteristics.	Percentage of Total Heat Available in Setting, Utilized in Carbonizing.	Chimey Loss.	Relative Figure of Economy
I.	Simple recuperation.	Secondary air heated.	38	28	0.84
II.	Double recuperation.	Secondary and primary air heated	68	16	1.00
III.	Simple recuperation, combined with recuperation of carbon.	Secondary air heated and portion of carbon in "waste gases" recuperated.	75	17	1.04

The majority of the recuperative settings constructed in this country belong to Class I., while on the Continent those possessing the characteristics of Class II. are much more common. A considerable increase of economy is claimed for the latter class, as evidenced by the comparative data given in the table, which has been calculated from particulars supplied by a leading Continental constructor.

The practical application of the recuperation of carbon is at present only in the embryo stage; but those who have made trials of the system under working conditions claim to have achieved complete success. There is no advantage whatever, from a theoretical point of view, in the recuperation of carbon from the carbonic acid in the "waste gases;" but it has been found in practice that the redistributive effect on the several heat zones is conducive to economy in working. The success of the system depends on the well-known principle that the value of any particular method of "setting" or working hangs more upon the excess of flue temperature over that in the retorts, rather than upon the total quantity of heat available; and also partly to reduced chimney losses. The method of its application to retort heating is illustrated by Figs. 7 and 8. About 20 per cent. of the "waste gases" are returned under the producer, and passed through the incandescent fuel, the result of which is the reduction of the bulk of the carbonic acid to carbonic oxide. This absorbs a considerable amount of heat in the producer; but, on the other hand, the gases are drawn in hot, and contain heat about equal to that lost by absorption. The use of steam is absolutely essential; otherwise a very high temperature is engendered above the grate bars.

The system has been applied by Mr. W. J. Jenkins, of Retford, and others; but, as far as the author is aware, it has been limited to combination with "simple" recuperation, though the data available appear to indicate the possibility of greater economy by heating the primary air supply also. The success that has hitherto attended the several trials appears to warrant experiments, on a more extended scale, at the hands of those in a position to make them.

It must be borne in mind, however, that, although settings constructed on the systems classed II. and III. show considerable economy in fuel account, they are not necessarily the most economical from a universal point of view. With "double" and "carbon" recuperation, considerable extra expense and complication are involved in construction, together with a necessity for greater care in working.

Efficiency.—The arrangements of flues in use at the present time for the purposes of recuperation are many and varied; some possessing great merits, by reason of their combination of simplicity of construction with a high degree of efficiency, while others exhibit a total lack of knowledge (on the part of the designer) of the essence of the recuperative principle.

The efficiency of recuperators is not only materially influenced by the character and extent of the passages for the transmission of heat to the incoming air supplies, but also by their location in regard to the producers. In fact, in certain forms, the degree of "true" recuperative efficiency attainable is entirely governed by the situation of the flues in relation to the sides of the generator.

Influence of Location.—The estimation of the real influence of location on the true recuperative efficiency, is a somewhat difficult and tedious operation, involving the classification of a mass of data based on observed results. These data should not be confined to figures deduced from any one particular form of recuperator, but ought to be fairly representative of that obtained from all the various types and systems in use, and, in addition, take account of the varying thicknesses of the division walls between the gas and air flues. The author has therefore compiled the following table, with the hope that it may be of service, not only as an illustration of the importance of giving due consideration to the question, but also as as a handy form of reference for those who may be desirous of estimating the degree of economy likely to be attained by the use of any particular arrangement of recuperative flues. This table has been calculated from figures chiefly obtained from French and German sources, and is approximately correct under average conditions.

*The Influence of Location on the Efficiency of Recuperators.**

Type	Situation of Producer.	Characteristics.	Fig. No.	Percentage of True Recuperative Efficiency as Compared with Unit Type.	Percentage of Total Heat in Secondary Air Abstracted from Producer and Setting.
1	Outside bench	Numerous passages for gases and air supply, with thin division walls.	1	100	..
2	Inside bench	Air flue sandwiched between gas flues.	2	90–95	5–10
3	"	Waste gas flue between air supplies.	3	80–90	10–20
4	"	Airflue between side of producer and waste gas flue.	4	60–80	20–40
5	"	Waste gas flue sandwiched between side of producer and air flue.	5	75–85	15–25
6	"	Air flue by side of producer.	6	6	94

* The minimum values of efficiency given are for settings of retorts 10 feet long; also for beds of 20 feet "throughs," with producers on each side. The maximum values may be taken for 20 feet "throughs," with producers on one side only.

Some of the figures given in the table may at first sight appear to be rather strained; but a reference to the conditions illustrated on the accompanying diagrams will tend to substantiate their correctness. Taking the type delineated on Fig. 4 by way of an example, it will be observed that in this case the air flue is sandwiched between the side of the producer and the waste gas flue; and it proceeds on the assumption that the temperature in the respective flues at the level AA is as follows: Waste gases, 800°; secondary air, 200°; producer, 3,000° and upwards. From this it will be seen that the excess of temperature in the producer over that in the air flue is 2,800° F., while that of the waste gases is only 600° F., or less than one-fourth of the former. Supposing also that the thickness of the producer wall is equal to that of the division tile between the gas and air flues, then the amount of heat abstracted from the producer would be at least four times that from the waste gases in the particular line of flue in question. In practice, however, the thickness of the generator walls is at the very least one and-a-half, and in general four times that of the flue division tiles; while the area of contact between the producer and recuperator only occupies a portion of the surface of the latter. The temperatures in the upper portions also practically balance one another; and, taken as a whole, more heat is found to be abstracted from the waste gases than from the producer, in this particular type of recuperator.

The lowest type, from the "true recuperative" point of view, is that illustrated by Fig. 6, which abstracts the whole of the heat imparted to the secondary air from the producer and body of the setting. It has no real recuperative action whatever, and owes the small figure of percentage efficiency given in the table to slight reduction in losses, due to radiation from the producer. Some engineers advocate the abstraction of heat from the producer in this way, with the idea of moderating the temperatures therein, and adduce arguments in favor of such a course; but at the same time they very properly disclaim any attempt at recuperation. In a particular case brought under the author's observation, the whole quantity of heat in the secondary air at the summit

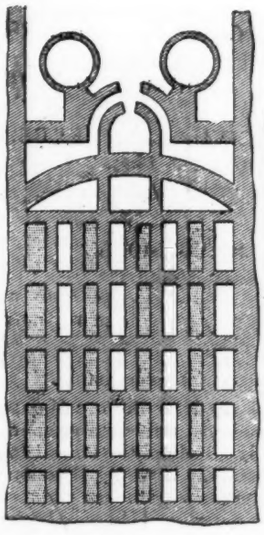

FIG. 1.

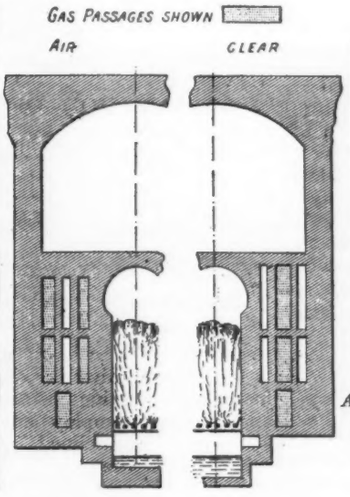

FIG. 2.

FIG. 3.

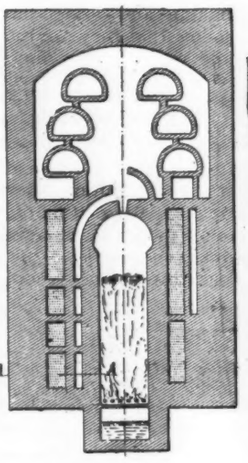

FIG. 4.

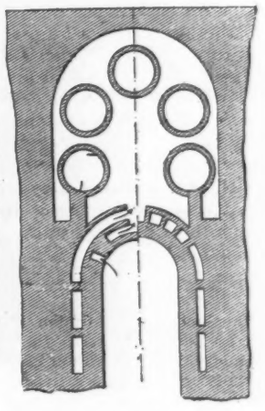

FIG. 5.

FIG. 6.

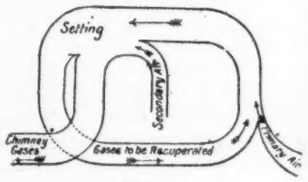

FIG. 7.

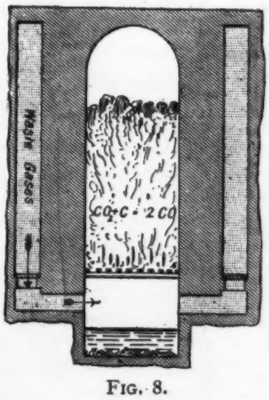

FIG. 8.

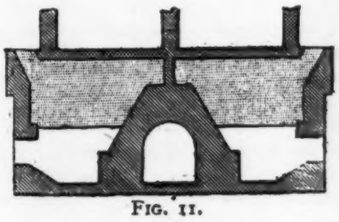

FIG. 11.

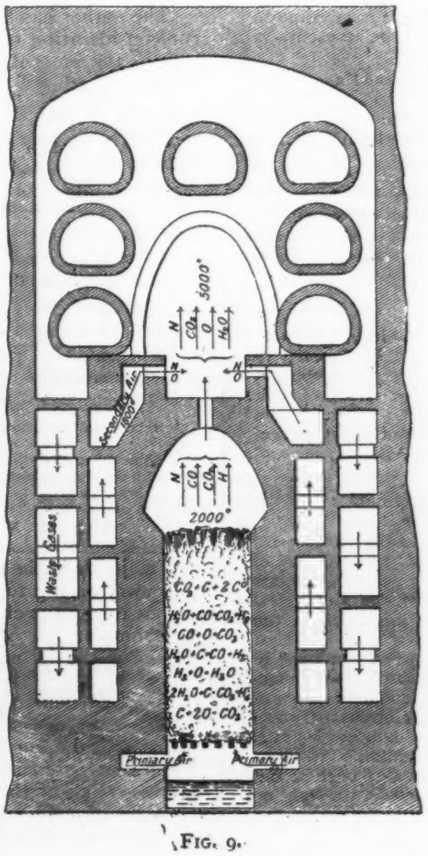

FIG. 9.

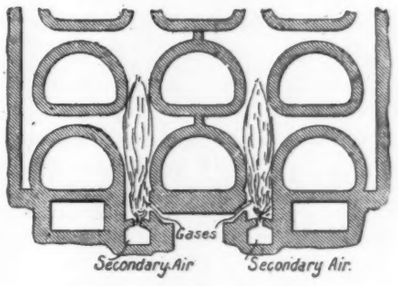

FIG. 10.

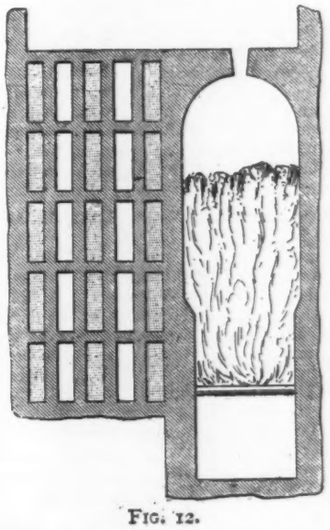

FIG. 12.

of a similar recuperator was credited as economy due to "regeneration," which was, of course, quite incorrect. The mere fact of air being "heated up" is not of itself any proof whatever of recuperation, but it is nevertheless a fruitful source of error in the estimation of economy.

The use of steam under the producers introduces a very disturbing factor in attempts to calculate the efficiency of any particular form of recuperator, as the work thrown upon them is much increased, on account of the additional quantity of secondary air required to be passed through, and proper allowance must be made for this, if even approximately correct data only are required.

Area of Recuperative Surface.—Reliable figures in regard to the extent and character of recuperative surface necessary for the transmission of a certain quantity of heat, at specified differences of temperature, are very difficult to obtain, owing to the disturbing influences mentioned in the preceding section. The author, however, has been fortunate enough to be furnished with the particulars of the working of two forms of recuperators, hereafter referred to by the letters *A* and *B* respectively.

Recuperator *A* was formed of specially molded blocks, with passages for air and gases passing through them; while *B* consisted of channels formed of plain division tiles, about 2 inches thick. The results of the two trials are given below, and are most useful in proving that efficient recuperation may be attained by very simple means, and that recuperator *A* contained at least double the surface necessary for abstracting heat from the waste gases:

	A.	B.
Area of recuperative surface in square feet per pound of coke consumed in generator per hour	5	2.62
Difference between the mean temperatures of air and gases	752° F.	620° F.
Heat units given up per square foot per hour	464	840
Heat units given up per square foot for each degree of difference in mean temperature	0.61	1.35

The main element of success in modern systems of carbonizing lies in the practical construction of the setting. This phase of the subject has already been fully dealt with on previous occasions, and therefore it is not considered advisable to lengthen this communication by entering into details under this head, other than to express a preference for the simplest styles of construction, such as that indicated on Figs. 2 and 3. Settings on either of the two systems shown can be constructed at a low capital cost, and are very efficient as recuperators. They also lend themselves excellently well to arrangements of flues which are readily accessible for cleaning and repair.

Use of Steam in Producer Furnaces.[1]—The advisability of admitting steam under producers is also open to dispute; and, in general, it is much more sparingly used in generators for retort heating than in similar furnaces employed for metallurgical and manufacturing purposes.

The author, having recently had occasion to investigate the question, made a series of inquiries in several directions, with the view of ascertaining the quantity of water vapor passed through the fuel by various engineers; but as the external supply is usually obtained from a boiler or boilers generating steam for the whole purposes of the works, the exact weight admitted to the furnaces was not generally readily ascertainable in every instance. Fortunately, however, in a few cases special methods were employed for producing steam and measuring the quantity of water evaporated; and consequently the data so obtained could not fail to be reliable. The several figures, when first contrasted, appeared to be incompatible one with the other; but a closer investigation dispelled this view, and indicated the factors governing success, under the conditions prevailing in each individual case.

Action of Steam.—The introduction of steam tends in all cases to reduce the temperatures of producers, but not necessarily the formation of clinker. In proof of this, it may be mentioned that in one particular case in practice (worked on a simple recuperative system) the injection of 20 per cent. of steam raised the zone of maximum temperature about a foot higher in the furnace, and created about 12 inches above the grate bars an arch of clinker which was much more troublesome than if formed in the ordinary way. On increasing the proportion employed to about 33 per cent., it was observed that the zone of maximum temperature was raised still higher, but reduced in intensity, and was then below that necessary for the fusion of the components of clinker. It was also discovered that reducing the whole supply of steam to well below the figure of 20 per cent. quoted, had a beneficial effect in preventing the formation of an arch of clinker, but did not get rid of the trouble of clinkering altogether, as was the case with the admission of 33 per cent. The results obtained in the particular case under review, therefore, appear to point to the inadvisability of following a medium course, and indicate the importance of avoiding the use of certain proportions.

The question of the best percentages to employ is rather a difficult one, under the varying conditions of working, and will be the more readily appreciated when it is stated that the data in the author's possession range from 20 pounds to 77 pounds of steam per 100 pounds of coke consumed in generators, and that these widely diverging figures were appropriate to the circumstances in which they were severally employed. With cold primary air, it seems to be advisable to either limit the steam supply to (say) 10 per cent., or increase it to at least 30 per cent. If the primary air is heated, the steam supply must be increased in proportion, approximately as given below:

Primary air, cold.....	33 per cent.	steam.
" heated to 400° F.....	44 "	"
" " 800° F.....	60 "	"
" " 1,100° F.....	72 "	"

Chemical and Thermal Changes.—The reactions which take place in a producer worked without steam are well known to be exceedingly simple in character. But this is not by any means the case when steam is admitted, as then not only is there an increased variety of primary combinations, but, in addition, further complex interactions are also produced; and again the balance of changes so produced is practically reversible, according to the influence of varying temperatures and quantities of water vapor injected.

As an illustration of the possibility of such reversals being brought about under the conditions existing in generators, reference need only be made to variations in the reactions between incandescent carbon and water vapor. At temperatures of 1,800° F. and upwards, the reaction between carbon and water vapor is practically $C + H_2O = CO + H_2$; but should the intensity fall below the limit given above, and undecomposed steam be also present, in excess, carbonic acid is produced, in accordance with the following equations:

$$C + 2H_2O = CO + H_2O + H_2 = CO_2 + H_4,$$

in increasing proportions as the temperature is reduced.

Other important chemical changes are also illustrated in Fig. 9.

There is also a considerable difference in the respective depths at which carbonic acid commences to be reduced, between generators worked with and without steam. In the former class, cases are known in which the carbonic acid has not been reduced at a height of 3 feet above the grate bars; while in the latter, a large percentage of carbonic oxide has been found in some cases at 12 inches up in the producer. It is therefore very necessary to have a deep fuel bed where steam is generously used.

The chemical efficiency of generators is slightly reduced by the use of cold coke, which, as is well known, contains a considerable quantity of water. When the coke is thrown in upon the top of the incandescent fuel, the moisture present in it is driven off into the crown of the furnace, as undecomposed water vapor, which reacts upon the carbonic oxide in the producer gases, in accordance with the following equation:

$$CO + H_2O = CO_2 + H_2,$$

and may also possibly vitiate any analyses of the gases which might be taken near the time of charging.

The dissociation of steam in passing through the incandescent fuel in the producer absorbs, or renders latent, a large quantity of heat, and therefore exercises a most beneficial action in moderating any excessive temperatures. It is almost needless to add that the exact quantity of heat absorbed in decomposing water in the producer is reproduced by combustion in the setting. The temperatures available for heating the retorts should therefore be theoretically constant, whether steam is employed or otherwise. It has, however, been found in practice that the combustion of the hydrogen (produced by dissociation of water vapor) is much quicker than that of carbonic oxide, and therefore produces a zone of relatively higher intensity, within certain distances of the gas and air nostrils.

It must be borne in mind, however, that a portion of the heat produced by the combustion of hydrogen is rendered latent, and must be discarded in calculations bearing upon the total quantity of caloric available for carbonizing; the total quantity of sensible heat units yielded per pound of hydrogen consumed being only 52,000, as against 61,500 when the resulting gases are cooled down to such an extent that water vapor is condensed to the liquid form.

Construction of Settings.—Success in the use of steam is also partly dependent upon the construction of the settings. If steam is largely employed where the combustion space is constricted as shown in Fig. 10, much trouble is caused by the fusion of the retorts and division walls, owing to the very high local temperatures engendered. The best remedy for the latter trouble seems to be in the use of a roomy combustion space, so that the full energy of the combustion may be utilized without any drawbacks. The provision of such a space, as opposed to that of an inclosed combustion chamber (irrespective of the use of steam or otherwise), has proved in practice to possess great and undeniable advantages, not only in the mitigation of cutting heats on the retorts, but also in the facility it gives for access to every part of the interior of the setting for purposes of repairs.

Variations in Air Supply.—The respective quantities of primary and secondary air required are governed by the quantity of steam injected; the former being decreased pro rata with the weight of water vapor admitted, while the latter is correspondingly increased—the total combined weight being theoretically constant.

The admission of steam, therefore, incidentally affects the work thrown upon the recuperators, as illustrated by the following table, calculated under three suppositional conditions:

	Without Steam.	33 per Ct. Steam.	77 per Ct. Steam
Primary air per pound of coke consumed..	5.5	3.5	2.56
Secondary " " " " ..	4.5	6.5	7.44
	10.0	10.0	10.0
Relative work thrown on recuperators....	1.0	1.44	1 64

The author ventures to think that, on the whole, the generous use of steam is an advantage, principally on account of the possibility of the reduction of some of the arduous work of clinkering. This statement, however, only extends to its use in settings, where the combustion space is ample.

Analyzing Waste Gases.—The methods in general use for analyzing waste gases are subject to considerable error, when applied to gases containing a large percentage of water vapor, such as is produced by the

1. In the case of producers with wet ashpans, the quantities of steam mentioned include that produced by evaporation from water in the pan, in addition to the external supply.

free use of steam under the producers. This water vapor, in most cases, is partly condensed out before the gases enter the burettes; and the results obtained represent the composition of the residual gases after the moisture is eliminated. Under ordinary circumstances, there is no practical disadvantage in this; but it is desirable, in experiments involving the generous use of steam, that the real percentages of water vapor present should be ascertained correctly.

It has occurred to the author on several occasions that it would be of some advantage to have a means of ascertaining the approximate composition of the waste gases by mere inspection. He therefore ventures to suggest the use of a modified arrangement of the Lux specific gravity balance, the scale being graduated to show percentages of carbonic acid, in lieu of specific gravity, as in the ordinary form of the instrument.

APPENDIX.—*Formulæ for Generator Settings.*

F = Weight of coke put into generator in pounds.

P^H = " primary air for producer fed with hot coke. .... $= 5.3$ to $5.8\ F - 3.81\ \phi$

P^C = " do. do. cold coke..... $= 5.0$ to $5.5\ F - 3.81\ \phi$

S^H = " secondary air — hot coke.. $= 10.0\ F - P^H$

S^C = " " cold coke. $= 9.6\ F - P^C$

VP^H = Volume of primary air — hot coke $= 13.14\ P^H$

VP^C = " " " cold coke $= 13.14\ P^C$

VS^H = " secondary air — hot coke.. $= 13.14\ S^H$

VS^C = " " " cold coke. $= 13.14\ S^C$

V = " of air = 13.14 cubic feet per pound, at 62° F.

ϕ = Weight of water or steam injected into producer in pounds.

G^P = " producer gases $= 0.83\ F + \phi + (P^C \text{ or } P^H)$.

$$T' = \text{temperature of gases leaving producer} = 2{,}800° - \frac{2{,}700\phi}{F}$$

G^{PV} = volume of producer gases

$$\frac{80\ F\left(2{,}800° - \frac{2{,}700\phi}{F}\right) + 461}{523}$$

or at temperature T' —

$$= 80\ F\frac{T' + 461}{523}$$

or at temperature 2,000° = 367 F.

G^S = weight of " waste gases" from setting
$= 0.83\ F + (P^H \text{ or } P^C) + (S^H \text{ or } S^C) + \Phi$

G^{SV} = volume of " waste gases" from setting at temperature T''

$$= 145\ F\frac{T'' + 461}{523}$$

or at a temperature of 2,000° F. = 491 F.

N = area of producer nostrils

$$= 80\ F\ \frac{\left(2{,}800° - \frac{2{,}700\ \phi}{F}\right) + 461}{150{,}000}$$

where F = fuel in pounds per hour.

T = theoretical temperature available in setting.

T'' = temperature of gases leaving setting $= 0.458\ T$ approximately.

T^{SA} = temperature of secondary air at outlet to recuperator $= 0.4\ T$ or $0.88\ T''$ approximately.

B.T.U. in waste gases
$= (0.83\ F + (P^C \text{ or } P^H) + (S^C \text{ or } S^H) + \Phi)\ 0.458\ T \times 0.253$; or

$$\frac{G^S \times 0.458\ T}{3.95}$$

Valuation Clauses in Municipal Franchises.

Engineering Record notes that among the papers prepared for the American Water Works Association's convention last week was one by Mr. John W. Hill, M. Am. Soc. C.E., on the method of constructing certain clauses in municipal franchises. While it is probable that his views will not meet universal approval, yet because this subject is one on which engineers are often called to pass judgment, it is desirable to give the greatest publicity to the opinions of all who have had actual experience as valuers and appraisers, to the end that the practice may become more uniform even in the absence of decisions of the courts fixing the methods of procedure. Much of the trouble in the valuation of semi-public properties would be obviated if the franchises under which they are operated contained a clause similar to that in the Indianapolis street railway franchise, reviewed in these pages on May 13, which reads: "The city of Indianapolis may at any time within two years and not later than one year before the expiration of this contract, and the period for which this franchise is granted, purchase of the said company, its successors and assigns, its property of every description, but the value of the franchise hereby granted shall not be included or considered in estimating the value of said property, it being the intention of the parties hereto that the value of said property to be agreed upon shall be the actual value thereof, independent of all franchise rights thereunder—the said city to pay nothing for franchise rights." Such clauses are not to be found in the contracts which come before appraisal boards at the present time, however, and the forms considered in Mr. Hill's paper will continue to try the patience and judicial spirit of arbitrators for many years.

In a franchise granted to a certain water works company there occurs, according to Mr. Hill, the following statement with reference to purchase of the works by the municipal corporation:

"The city shall have the right to purchase from the company all the buildings, machinery and pipe of said water works, and all its corporate rights and privileges (but not including any franchise herein granted or that may hereafter be granted to the company, nor including any estimated value of this charter), at such price as may be agreed upon by the common council and board of directors of the company."

The language of this clause seems distinct, and the prevailing opinion of lawyers and commercial bodies of the city in question was that the business established by the company or its future prospects should not be considered in valuing the property. The company took a different view and put a value on its property which was far in excess of the value of the tangible property, and one which could be attained only upon the supposition that the city was required by the contract to pay for an established businesss, or value the property upon its capacity to produce a net revenue, which, when capitalized at the present value of money, represented a present worth 75 per cent. greater than the value of the tangible property.

A franchise for water works in another city contains the following provision with reference to purchase of the works by the municipal corporation:

"At the expiration of ten years from the completion of said works the city shall have the right to purchase said works from said grantees, at such price and upon such terms as may be mutually agreed upon, but in case no mutual agreement can be made, the said city may give notice, not less than six months in advance, of its intention to purchase said works by arbitration, and thereupon said city shall select one non-resident, disinterested person, said grantees shall select one non-resident, disinterested person, and the two thus selected shall select a third non-resident, disinterested person, and they shall constitute a commission, who shall examine and take testimony of experts, and otherwise determine the value of said water works and property, not valuing the unexpired term of franchise."

In this instance the municipal corporation by its law officer held that a limited consideration should be given to the net earning power of the works; not that the city was bound under the ordinance to recognize it, but as a means of reaching an agreement with the company to sell the property. On the other hand, the company ignored or otherwise construed the limiting clause "not valuing the unexpired term of franchise," and insisted that the city should pay a price which was unattainable by any mode of calculation known to Mr. Hill.

The ordinance under which gas is furnished to one of the largest cities of the United States contains the following clause touching the purchase of the works by the municipal corporation:

"That at any time after the expiration of the said 25 years the said city council shall have the right and privilege of purchasing from said C., his associates, their heirs, assigns or successors, their pipes, buildings, fixtures and other apparatus owned and used by them in and about providing the city and citizens with gas, at a fair price and compensation. And the said price and compensaiion shall be ascertained and determined by five disinterested persons, two of whom shall be selected by the city council, and two by the said C., his associates, their heirs, assigns or successors, and the fifth by the four thus selected or chosen."

The value of the real property in this example cannot exceed $6,000,000, while the business is stocked at $8,500,000, upon which a 10 per cent. annual dividend is paid in quarterly installments, and the stock within 30 days has sold at $2.10 upon each dollar of its par value. No controversy has arisen upon the method of arriving at the value of

this property, but undoubtedly it will arise when the city undertakes to purchase it.

Referring particularly to the first two of the three clauses affecting the purchase of a public utility by the municipal corporation, the question that arises is how far, if at all, the established business, or the business which investigation may show can be established in pursuit of such public utility, should enter into the estimate of the value of the property to be transferred by purchase, from a private to a municipal corporation.

The definition of the term "franchise" implies the power to construct and operate certain works for the comfort or convenience of society, either directly by society itself, through its legally deputized officers, or by giving to private individuals the authority to do the same under such limitations and restrictions as may be imposed by the social corporation and accepted by the private company. A water works company without a franchise to supply water to an organized community, would have no use for pumping engines and reservoirs which it might happen to own ; and after all it is in the judicious and prudent exercise of the State authority conveyed by a franchise, that the company operating under it is enabled to render of real value the various details of its works which consitute the tangible property. Separated from the franchise, the appurtenances to a water works or other utility have only such value as an intelligent and experienced estimator would attach to them ; and this value would be the same whether the private corporation to which they belonged was either making or losing money in the performance of its franchise duty. In ordinances of municipal corporations conferring franchise privileges upon equal public corporations, in which the stipulation is distinctly made that when the property is valued for purchase by the city, no value shall be given to the franchise or to the charter ; or where the term is employed in arriving at the value of the property of a company, that such value shall be arrived at without valuing the unexpired term of franchise, the question arises whether such terms of the ordinance do not clearly and unequivocally mean that, when the property or public utility is valued for purchase by the municipality, no consideration whatever shall be given to the established or assumed earning power of the real and other property necessary to operate and maintain the service contemplated by the franchise.

Having served on several important commissions for the appraisement of value of water works and other properties of like character, and being familiar with the terms of the contracts under which many of them are now worked, it has seemed to Mr. Hill that in the inception of some of these enterprises, the intent of such language as is quoted in this paper is to inhibit the use of the revenue producing power of the property as a factor in determining its present worth.

In making this statement, he assumes that it will be accepted as applying only to those contracts which are so written, or seem to be so written, as to eliminate from consideration in valuing the property, the franchise or charter ; and should not be accepted as applying to contracts so written as to leave in doubt the matter of imparting a value to the established business ; or where it is distinctly provided that such business shall enter into consideration in arriving at the present worth of the public utility.

Referring to the first quotation from the ordinary granting of a public franchise, the term is used "but not including any franchise herein granted, or that may hereafter be granted to the company, nor including any estimated value of this charter." The terms "franchise" and "charter" in this instance should be construed as meaning the good will of the business, or its net revenue producing capacity, and the franchise as such is worth at any time only what the operation of the business has shown it to be worth. In short, the franchise can have no value beyond that obtained from proper consideration of its capacity to produce net revenue, and the net revenue directly measures the present worth of the property, from which should be deducted the value of the tangible property to arrive at the value of the franchise *per se*. In fixing the value of such works when the language of the ordinance granting the franchise clearly states that no value shall be given to the franchise granted, and the value shall be arrived at without valuing the unexpired term of franchise, no value should be given to what in business operations is termed good will or value of established business and prospect of gain in volume of business.

Referring to the third quotation from a municipal ordinance granting the right to construct and operate gas works, the language is less clear because in this it will be noticed, after citing the "pipes, buildings, fixtures, and other apparatus," owned and used by it, that there is no provision for valuing the business established by the company, or providing for a valuation of the franchise "at a fair price and compensation, and the said price and compensation shall be ascertained and determined," etc.

There is room for doubt as to how such a clause with reference to purchase of the works should be construed. Eminent lawyers upon the one hand have assumed that in the absence of a provision in the ordinance to value the business of the company, that the clause, "a fair price and compensation," shall be based entirely upon the real and other property of the company, not including the franchise obtained from the city council, and upon the other hand, that in the absence of a provision to the contrary, this clause shall be construed as allowing the appraisement commission to include the value of the established business in fixing the price to be paid. It is possible that these matters are purely within the domain of the law, and do not involve engineering questions, but before they have been ruled upon sufficiently by the courts, and hard and fast dictums have been established, engineers will frequently be called upon to construe contracts or ordinances containing provisions resembling more or less the three quotations upon which this paper is based, and will be required to discuss their merits from at least a semi judicial standpoint.

It is obvious that a city council and a company operating a public utility cannot agree upon a mode of valuation which traverses the original grant or varies its terms ; and to avoid conflict between the respective parties to the valuation and purchase of such public utility, it is eminently desirable that a rule be established by which a commission chosen to appraise a public utility shall be governed in fixing its present worth. Mr. Hill is of the opinion that in contracts for performing a continued public service, or operating a public utility, in which language is found like that in either the first or second references quoted, that the contracts contemplate only the valuation of the tangible property, and do not contemplate attaching a value to the "good will" of the established business, as at the date of appraisement and sale.

Referring to the first two contract purchase clauses quoted, whatever value has attached to the expired term of franchise has been enjoyed by the company, and whatever value attaches to the unexpired term of franchise, after appraisement and sale, is to be enjoyed by the municipal corporation. If this were not so, then the authority or privilege which was conveyed as a gratuity by the municipal corporation to the company could be recovered only by paying for it, in which event the municipal corporation would be put in the attitude of a bidder for its own prerogatives, and would be compelled to pay as much as an alien bidder or financial speculator might be willing to offer.

The adjustment of value of a public utility may not be favorable to one of the parties to the purchase and sale, but that is a fault of the contract under which the use of public privileges was originally conferred, and would have to be accepted because it was a contract condition. When the terms of a contract can be waived and the appraisement of valuation based upon equity, then undoubtedly the municipal corporation should recognize the expenditure of time, money and effort required to overcome the difficulties and financial dangers surrounding the starting and successful establishment of so-called public utilities, and the value of such should not be measured by the simple estimate of real and other tangible property, but be based upon the proved capacity of such works to earn a net revenue. Provided, however, that upon this mode of estimate the value of the property shall not be less than the cost of reproducing it, or of building a works equal in capacity and efficiency, for it would be hard to assume that any company should be required to part with its property at a price less than the cost of duplicating that property. But it will so fall out that by any general method of valuation, in some examples, the property will be valued at less than its real worth, while in others the value will be more than the municipal corporation should be required to pay. Mr. Hill mentioned two of the larger cities of the country, the water works of which are owned and operated by private companies. In one of these, if the valuation is based upon the net earnings of the company, its present worth will be much less than the cost of construction of equivalent works ; while in the other case, if the property is valued at the cost of reproduction, the value will be much under the price which it would bring as a revenue producing enterprise.

Improvements in the Analysis of Gas.

The *Gas World* calls attention to the fact that Dr. Otto Pfeiffer, of Magdeburg, points out that when nitrogen is estimated in the ordinary way, by finding the other components and reckoning the remainder as nitrogen, all the errors accumulate in the nitrogen. The ordinary simple explosion method of analysis is therefore passing out of use, for this and for other reasons. But it appears to Dr. Pfeiffer that to aban-

don the explosion method entirely, in favor of separate determinations of each of the components, is "to throw away the baby with the wash water." The methods now in use are not without their faults. The absorption of carbonic oxide by cuprous chloride is defective; the fractional combustion of hydrogen and marsh gas gives rise to complications, and in the result the values for the nitrogen range all the way from 0.5 to 4 per cent. Even Jäger's method (*Gas World*, 1899, page 556) leaves something to be desired. The method Dr. Pfeiffer adopts is a mixed absorption and explosion method, which has been tested by experience, and which is very prompt.

He takes a Bunte burette, with its lower end permanently connected with the lower part of a level flask by means of rubber tubing. The liquid used is water reddened by litmus and acid. The transverse channel in the upper stopcock is closed, so as only to leave the longitudinal boring free (Fig. 1). The absorption pipette (Fig. 2, and *P*, Fig. 1) has a funnel and stopcock as shown, the stopcock being of the same form as that shown at *b*; an arrangement which prevents there being waste space when the pipette is connected with the burette. The first thing to do, in order to get the measured gas out of the burette into the absorption pipette, is to get the air out of the junction, *b s p*, by setting the stopcocks as shown in Fig. 1 (position *I*), and filling the funnel heads, *F* and *F'*, with water, by pouring water into one of them.

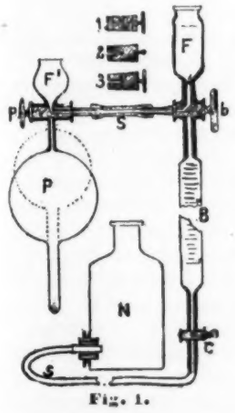

Fig. 1.

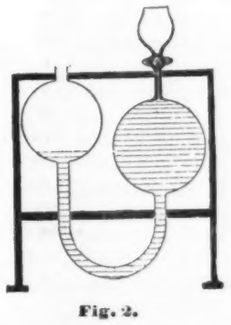
Fig. 2.

Then set the stopcock *p* in position *II*, at right angles to the former, and the buretle cock *b* in position *III* (at 180° to the former). Then, by raising the level flask *N* the gas in the burette is put under pressure, and by carefully turning the stopcock *p* back into position *I*, the thread of water in *b s p* is driven into the funnel head *F'*; and this may be completely accomplished without any loss of gas. Now turn the stopcock *p* into position *III*, and then the measured gas goes over into *P*; and turning the stopcock *c'*, stops this so soon as the liquid appears trying to emerge into *P*. To get gas back from the pipette into the burette, *N* is lowered, *c* is opened; the absorbent liquid is allowed to ascend the capillary neck of *P* as far as the stopcock *p*, and then *p* is turned 180° into position *I*, and water from *F'* follows the gas into the burette *B*. When *b s p* is quite full of water, stopcock *p* is first closed and then stopcock *b*, both in position *II*.

Fig. 3 shows the explosion pipette. It has a very small capacity, only 150 cubic cm. This enables the walls to be blown thick, and reduces the quantity of mercury required. At *D* there is a rubber tube for attachment to the burette. The level flask used is like *N* in Fig. 1. The pipettes here described are made by Kähler and Martini, 50 Wilhelm str., Berlin.

In analysis, the absorption of CO_2 in the absorption pipette *P* is complete in about 1 minute; that of heavy hydrocarbons in fuming sulphuric acid in about 5 minutes, with shaking; but after fuming sulphuric acid the gas must go to alkali, in order to get rid of the acid vapors, which might make an error of ½ per cent. The reading of the volume of gas is to be done 1 minute after adjustment; and it needs a small mirror for accuracy. For explosion, 20, or, at most, 22 cubic cm. of the residue (according to the expected composition of the gas) is to be led into the explosion pipette until its capillary tube is filled with water, and no more. Close the upper stopcock *e*; disconnect from the burette; then fill the burette *B* with air down to the lower mark (110 cubic c.m.) Now fill *b s p* with water and reconnect with the explosion pipette. Turn stopcock *b* into position *III*, put the gas in *R* under light pressure, and open the stopcock *e*; this drives the thread of water back into the burette and prevents any drop of water entering the explosion pipette and affecting the electrode wires. Now transfer the 110 cubic cm. (or whatever the exact volume is) of air from *B* to *R* until the capillary tube above *R* is filled with water, and close *e*. When *R* is free from mercury, which stands only in the lower capillary tube, close *f*. Keep a thick piece of glass before the face during the explosion.

The products of the explosion come to about 100 cubic cm.; and they, therefore, can be readily measured in the burette. If any mercury gets into the burette it must be manœuvered into the level flask *N*, where it may be allowed to remain. In the capillaries it would interfere seriously with the readings.

After determining the contraction comes finding the amount of carbonic acid produced; and then the removal of oxygen, which, with phosphorus, takes about 5 minutes, not more if the pipette be held in the hand. It is not necessary to wash with alkali, for the small proportion of phosphorus vapor which clearly does remain is not sufficient to affect the results.

The oxygen in the gas is determined separately by means of the Bunte burette, by a colorimetric method introduced by the author some years ago. Absorption methods are not satisfactory for oxygen For example, reduced indigo only takes 75 per cent. of oxygen after 10 minutes shaking; and hydrated oxide of manganese and colorless cuprous chloride are not much better. An alkaline solution of pyrogallic acid will, however, absorb all the oxygen with about five minutes' shaking; and it darkens very much (though after some time the tint tends to become lighter), the darkening not being much affected by the ordinary variations of the temperature. Sulphureted hydrogen makes the resultant color a somewhat redder one. The method then is: Measure 100 cubic cm. of gas in the Bunte burette; withdraw the water and let in from beneath 5 cubic cm. of a 50 per cent. solution of caustic potash. (Mark, once for all, the height at which it stands). Put 0.2 gramme of dry pyrogallic acid in the funnel, *F*, and add 2 cubic cm. water; the pyro promptly dissolves. Let down the solution into the burette, leaving only the capillary neck filled with a drop of the solution. Shake slowly for five minutes. Then from below introduce oxygen-free (water boiled in an open vessel) up to a certain mark, preferably the zero; shake up, and in two minutes compare the tint with that in another tube containing a dilute solution of caramel. So many drops of prepared caramel solution into the color tube correspond to so much oxygen absorbed in the burette. To make the caramel dissolve 30 grammes of cane sugar in a liter of cold water brought to the boil; add 30 cubic cm. of 33⅓ per cent. sulphuric acid and boil for 15 minutes; then slowly add 85 cubic cm. of caustic

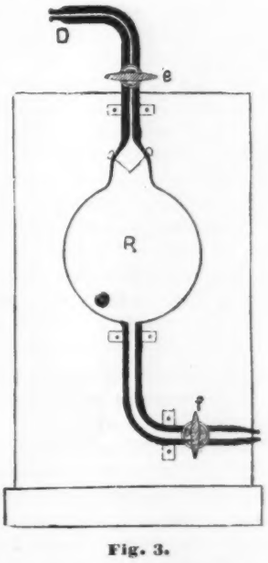

Fig. 3.

soda solution of specific gravity 1.30. The first 30 to 35 cubic cm. are enough for neutralization; the remainder affects the color. Keep on boiling for another 15 minutes. Caramel solution prepared in this manner does not alter at all in color if kept in the dark, and it exactly matches the color of pyro darkened by oxygen. It is an easy matter, taking the requisite trouble, to make a series of gaseous mixtures containing ½, 1, 2 and 3 per cent. of air, and to ascertain the number of drops of caramel solution, dropped from a given burette, that are necessary to give the required tints corresponding to agitation of the burette for a given number of minutes (5 minutes), and observation 2 minutes afterwards. Putting these down on squared paper enables the intermediate

value to be at once read off, on a freehand line drawn through the points in the usual way, when intermediate numbers of drops are found to be the numbers required, under the same conditions, to get up the exact tint. Dr. Lubburger doubts the permanency of this caramel solution. Dr. Pfeiffer says it is permanent, but indicates that a 1-tenth normal solution of iodine (two of KI to one of I) will do very nearly as well.

The following is an example of the data obtained in an analysis conducted according to Dr. Pfeiffer's method, and of the mode of interpreting them. Initial volume of gas examined, 100 cubic cm.

A. *Absorption.*—Alkali absorbs 1.7; sulphuric acid, 3.4; therefore $CO_2 = 1.7$; $C_nH_{2n} = 3.4$. Residue, 94.9; which, *less* the oxygen separately determined (= 0.23—C, below), gives a true residue of 94.67.

B. *Explosion.*—Of the residue (= 94.9) take 20.5 cubic cm.: that is, $\frac{20.5}{94.67}$ of the true residue. Air added, 109.9 cubic cm.; total, 130.4; after explosion, 99.0; contraction, 31.4. Carbonic acid by absorption, 8.0, leaving 91.0. Excess oxygen from the added air, absorbed by phosphorus, leaving total nitrogen 87.2. This, less the nitrogen of the added air (= 86.87), gives 0.33 nitrogen in the 20.5 cubic cm. of residue used. In the residue we have by the usual calculations, based on the residue being after deduction of its nitrogen equal to 20.17 cubic cm., that CO was 1.91, CH_n 6.10, and H 12.17. These figures multiplied by $\frac{94.67}{20.5}$ give CO = 8.9, CH_n = 28.1, H = 56.2; and the N = 0.33 in the residue gives N = 1.5 per cent.

C. *Oxygen.*—The number of drops of caramel solution required was 14; therefore, the oxygen was 0.23.

The variation in the results are singularly small, and the analysis takes from 45 to 50 minutes, so that, with estimation of oxygen, heating value, specific gravity and lighting value, each complete examination of the gas takes about two hours. The above method has been in use in the Magdeburg works for a considerable time.

Dr. Lubburger found that, in order to control the air purification at Carlsruhe, he needed an exact process for the determination of the oxygen; and under the advice of Dr. Bunte he modified Winteler's process for the determination of oxygen in water, arranging it so that Bunte's burette could be employed. This process consists in oxidizing an excess of sesquioxide of manganese in presence of alkali by means of the oxygen dissolved in water; then the addition of iodide of potassium and hydrochloric acid causes the liberation of an amount of iodine equivalent to the oxygen, which iodine is titrated by means of a solution of thiosulphate of soda. The required solutions are: (*a*) 10 grammes caustic soda, 35 grammes crystallized sodio-potassic tartrate, 8.5 grammes KI, water to 300 cubic cm. bulk; (*b*), 14.5 grammes sulphate of manganese, water to 100 cubic cm.; (*c*), 2.480 grammes hyposulphite of soda, water to 1 liter (= $\frac{1}{100}$ normal). Water is also required, completely freed from air.

The burette is first filled with water, the gas is allowed to enter under pressure by the upper 3-way cock, and the burette is emptied. Then close the lower cock and turn the upper 3-way cock half a complete revolution. With rubber tubing and glass rod close up the outlet of the 3-way cock. Then introduce about 5 cubic cm. of de-ærated water, until there is about a cubic cm. above the stopcock. Close the upper stopcock in its original position. Carefully open the lower stopcock and make the water run out as long as the capillaries above and below remain full. The manipulation is modified if the gas has to be aspirated from a holder. Then, according as the gas is taken behind or in front of the purifiers, that is to say, according as it contains sulphureted hydrogen or not, there are two cases:

(1) *Purified Gas.*—Pour through the upper stopcock 1 cubic cm. solution (*b*); then, through the lower, 3 cubic cm. solution (*a*). Hold the burette by the middle and shake energetically, vertically, for 10 minutes. Then pour in below 1 cubic cm. concentrated HCl (25 per cent.) and shake. If there were oxygen, the liquid will now be yellow (iodine). Get the liquid out, rinsing the burette till the washings do not color starch.

Add to the liquid in the beaker a little starch solution, which makes it blue; titrate with solution (*c*) until the blue color disappears. From the solution (*c*) employed subtract 0.3 cubic cm. Then each cubic cm. of solution (*c*) corresponds to 0.06 cubic cm. of oxygen.

(2) *Crude Gas.*—We have to get rid of the H_2S. In the burette introduce, below, 2 cubic cm. of a solution of iodine (iodine 5 grammes, KI 10 grammes, water 100 cubic cm.) and shake; then remove this solution and wash out with a minimum of de-ærated water. Then proceed as before.

Notes on Suction Pipes.

At a meeting of the Western Society of Engineers, Mr. D. W. Mead, C.E., presented and read a paper, on the mechanics of suction and suction pipes, that brought out a lively discussion. A main participant in the debate was Prof. A. N. Talbot, C.E., who remarked that vacuum chambers are used for two purposes: First, to act as reservoirs to receive and discharge water under the varying velocity of the stroke and thus to avoid shock and slip; second, to serve as traps to collect air from leaky suction pipes or from supersaturated waters. For the first purpose the chamber should be placed as near the pump as possible and in a direct line with the motion of the water before reaching it. Generally this will place it immediately above a vertical suction pipe and beyond a horizontal one or beyond the pump suction chamber. It should have the same diameter as the suction main and extend vertically as high as the regular velocity of the water would carry it in the interval between the closing and the opening of the suction valves, and should have a space above this point sufficient to prevent shock. It should not contain much water at the time of the full velocity of stroke, for this would leave a mass to be started and stopped at every acceleration. For the second purpose, an auxiliary air pump should be used to avoid the loss of energy and of discharge by pumping air through the main pump and to avoid the shock due to sudden realeases or gulps of accumulated air. Much care has to be taken in the use of such apparatus to make it effective.

It is not strange that the head lost in pump valves and water passages is quite high, when the velocity head, entrance head and friction head through the valve openings are considered. Take the case where the area of valve openings is one third of that of the plunger, and consider a plunger speed of 2½ feet per second. This requires an average velocity of 7½ feet through the valve openings, giving a velocity head of 0.85 foot. The entrance head will probably be nearly as much, and the resistance through the valves even more. As practically all the velocity head is lost, this would make at least 2.5 feet, and the same amount through the discharge valves would bring the total loss to 5 feet. With stiff valves and passages arranged to require a reversal of current, the resistance through the pump may become very large. It may be doubted if it often comes as low as 5 feet. Some pumps tested here gave 11 feet. The new Aurora pumps, having a capacity of 6,000,000 gallons per 24 hours, and giving a duty of 124,000,000 foot-pounds, in a test by Prof. L. P. Breckenridge, of the University of Illinois, gave a loss through valves and pump passages of 14 feet. More attention should be given to the designing of these parts.

The actual effect on the suction of the confined gases will depend upon whether their amount is in excess of the point of saturation at the pressure or vacuum to which the water is subjected, and the point of duration or time element during which the water is at a considerable suction height. It is likely, also, that the amount of free surface exposed, similar to evaporation surface, will govern the amount of the discharge. While most waters are well within the limit of saturation for atmospheric pressure, many ground waters contain large quantities of gas, which become troublesome at medium or high suction lifts. Likewise, the usual condition of vertical suction mains gives only two or three seconds of time for the water to remain at reduced pressure, a time too short to permit of the escape of much gas; but a gang system of driven wells may have a considerable length of connecting suction pipe at or near the level of the pumps, thus giving much more time for the release of the gases.

That the quantity of gas given off under ordinary conditions cannot be large is shown from a determination of air accumulation made incidentally in some experiments with 2-inch siphons by Messrs. Ketchum and Seastone, under the direction of Prof. Talbot three years ago. The inlet leg of the siphon rose vertically for the full lift. At this level 162 feet of horizontal pipe was placed, and at the end of this the outlet leg descended vertically to the outlet tank. Near the outlet leg a connection with the horizontal run of pipe was made to an air chamber. The amount of air accumulating was measured after stopping the experiment by metering the water required to fill the apparatus. While the apparatus was fairly tight, it was known there was some leakage. The water used was from the city water works. Part of it was pumped over again, but was subject to aeration in passing over a weir and through four tanks. The vacuum at the summit was measured with a carefully calibrated vacuum gauge, and checked closely with the sum of the lift or rise, the velocity head, the entrance head and the friction head. The highest vacuum used, 30.1 feet of water, is within about 2.5 feet of the probable highest vacuum obtainable with the atmospheric conditions existing. The limitations of the apparatus

and its location would not permit experiments under a higher head. It will be seen that the time the water was under the vacuum ranged from one to two minutes, a much longer time to exposure than is usual with suction pipes.

It may be said that the construction of the siphon was not such as to allow the liberation and reabsorption of the air before reaching the outer leg. In the table the amount of rarefied air at the vacuum of the high point of the siphon is given as a percentage of the quantity of air passing through the siphon. The head, lift and vacuum are given in feet of water, the velocity in feet per second.

Head on siphon	8 4	8.4	8.4	8.4	2.75	4.3	1.9
Lift.....	21.5	21.5	21.5	21.5	21.5	27.5	27.5
Loss to outlet leg	6.6	6.6	6.6	6.6	2.7	2.6	1.1
Ind. vacuum...	28.1	28.1	28.1	28.1	23.7	30.1	28.6
Time.....	1:50h.	1:45h.	9:30h.	8:55h.	8:15h.	27:40h.	1:20h.
Velocity.....	3.4	3.4	3.4	3.4	2.5	2.2	1.4
Rar air, p. cent.	0.05	0.05	0.025	0.01	0.015	1.02	0.02

No relation can be deduced with reference to the release of air at different pressures, since it is known that in some cases a considerable part of the accumulated air is due to air confined in the siphon during the process of filling. At New Rochelle, N. Y., a 12-inch siphon 925 feet long, constructed by Mr. J. N. Chester, Assoc. M. Am Soc. C. E., and described in *The Engineering Record*, of August 12, 1893, under lifts of 18 to 23 feet, accumulated air at a rate of 125 cubic feet of rarefied air in 12 hours, which was at the rate of 0 1 per cent. of the volume of the water flowing or 0.04 per cent. of free air. This was surface water from an impounding reservoir. It was known that there was considerable air leakage in this siphon.

While the accumulation of air given in these experiments is small, it must be borne in mind that many ground waters are heavily supersaturated with gases and offer quite different conditions. The experience of Professor Talbot with gang driven wells in the drift indicates that such waters may give considerable trouble even at low lifts. However, it is believed that the greatest source of trouble with air accumulation lies in leaky suction pipes. This is augmented by the great difficulty in making joints air-tight, as compared with water-tight joints, and by the fact that at high lifts the pressure of the outside air is many times that on the inside. There is special danger in the gang system of wells where the casing of each well extends above the surface and has several above the connecting suction pipe, which, of course, are not covered with water. In this connection it may be said that a water jacket offers a good protection against leaky suction pipes.

Where long suctions at high lifts are to be used, the pipe should never be horizontal nor have a summit before reaching the pump, but should be laid on a sharp ascending grade. This will allow air to escape to the pump as fast as liberated and will prevent the accumulation of bubbles or masses of air, which may have serious consequences in finally passing off. The use of a bell shaped mouth for suction pipes with high velocities is to be commended, but in general a conical mouthpiece with a diameter double that of the suction pipe will give sufficiently good results

A rather unusual case of a pump being used under a considerable head on the suction side may be noted here. At Decatur, Ills., the water is pumped from the Sangamon river to filters and reservoir on the hill above the station. From the reservoir the water passes to pressure pumps under a head of 70 feet, and is pumped into the distributing mains. A chamber 5 feet in diameter and 12 feet high is placed on the suction side and another of the same size on the discharge side of the pump. Air is kept at the proper height in these by means of an air pump. Cards taken from the pump showed satisfactory working both with the usual discharge pressure of 90 pounds and ordinary consumption of 2,000,000 gallons per 24 hours, and also with the fire pressure of 140 pounds and four large fire streams as additional discharge. Until May, 1898, the water from the reservoir was permitted to flow down hill to a pump well below the pumps, thus losing all the energy in the 70 feet of head.

[From *Engineering*, London.]

Illicit Commissions.

In the course of his recent remarkable address to the Upper House, when introducing a bill for the suppression of secret commissions and other nefarious practices, the Lord Chief Justice cited instances of underhand dealing in nearly every department of professional and commercial life. His speech, as reported in the *Times*, is of such great interest and will have been so widely read that it is unnecessary to refer to it at any length. Before dealing with one or two of its important features, however, a short exposition of the doctrines of the common law upon the question of secret commissions may be found useful. It has always been a fundamental idea both at common law and in equity that between principal and agent there must be perfectly fair dealing. In appointing an agent to transact a negotiation it is essential that a man should be able to place unbounded confidence in his representative, who acts not on his own behalf, but for and in the shoes of some one who pays him at an agreed figure. Anything in the nature of fraudulent concealment or secret commission places a limit upon the confidence which a principal, in justice to himself, should be able to place in his agent. Moreover, in becoming party to such a concealment the subordinate renders himself liable to an action at law. For the present purpose it is only necessary to refer to the case of Morrison v. Thompson (L. R. 9 Q B. 481), which was tried in the Queen's Bench Division so long ago as 1874.

In that case an action was brought by the purchaser of a steamship called the "Atrato" to recover from the defendant Thompson, who had been employed by the plaintiff as broker to purchase the ship as cheaply as possible, the sum of £225 which he had received by way of commission on the sale. It came to light at the trial that Mr. Morrison had authorized his agent to negotiate for the purchase of the ship on the basis of an offer of £9,000, but the ship was eventually purchased for £9,250.

Some time prior to the sale an arrangement had been made between the vendor and a broker named Scott, through whom the ship was sold, that if Scott could sell the ship for more than £8,500 he might retain for himself whatever could be obtained in excess of that amount. The defendant was aware of this arrangement at the time when he was negotiating with Scott for the purchase of the vessel, but it was unknown to the plaintiff; and before the sale it was arranged between Scott and the defendant without the knowledge or sanction of the plaintiff, that the defendant should receive from Scott a portion of such excess of purchase money. The vessel having been sold for more than the £8,500, the sum of £225, part of the excess, was paid to the defendant without the plaintiff's knowledge or consent. A more flagrant case of double commission can hardly be conceived. In the course of his judgment, Cockburn, C.J., said: "In our judgment the result of these authorities is that whilst an agent is bound to account to his principal or employer for all profits made by him in the course of his employment of service, and is compelled to account in equity, there is at the same time a duty which we consider a legal duty clearly incumbent upon him, whenever any profits so made have reached his hands, and there is no account in regard to them remaining to have taken and adjusted between him and his employer, to pay over the amount as money absolutely belonging to his employer." Judgment was given for the plaintiff for the full amount. This is but an instance of a number of similar cases.

In Mr. Story's famous work on "Agency," we find the following passage: "It may be laid down as a general principle that in all cases where a person is either actually or constructively an agent for other persons, all profits and advantages made by him in the business beyond his ordinary compensation are to be for the benefit of his employers." And in Gillett v. Pepercorne, Langdale (M. R.) said, "Where a man employs another as his agent, it is on the faith that such agent will act in the matter purely and disinterestedly for the benefit of his employer, and assuredly not with the notion that the person whose assistance is required as agent has himself in the very transaction an interest directly opposed to that of his principal."

So much for the attitude of the common law. Transactions which have hitherto been set aside as void for want of good faith are in future to be stamped as criminal. By the third clause of the proposed act:

"Every valuable consideration given or offered to any agent by any person having business relations with the principal of such agent, shall be deemed to have been corruptly given or offered unless it be proved (*a*) that the principal had given his consent thereto, or (*b*) that the valuable consideration was not calculated or intended, and had no tendency to corrupt the agent by inducing him to do or to leave undone something contrary to his duty, or by creating any other undue influence on the mind of the agent."

It will be seen that this clause is carefully framed so as to exclude from the operation of the Act the thousand cases in which perfectly harmless commissions are paid in everyday life.

One of the most important conclusions at which the select committee of the Chamber of Commerce have arrived is that in which they state that in many cases bribes often given unwillingly in the first instance, gradually become a necessity to those who have every wish to deal fairly by their employers. Tempted at the outset of his commercial career to secure an order by this means, the unfortunate traveler finds that unless he continues to secure customers in this way the pages of his order book remain blank. Such men, to use the Lord Chief Justice's words, "hate the practice and want to get rid of it, but feel bound hand and foot."

It should be observed that the principle of the proposed measure is not new. The Act of 1885, passed at the instance of Lord Randolph Churchill, made bribes to employees or officials of public bodies a criminal offence to be dealt with by severe punishment, and that Act has effected the purposes for which it was passed. If we are at liberty to judge from the paucity of convictions for offences of this kind, it would appear that the Corrupt Practices Act has almost eradicated the evil which it was intended to expunge. It is sometimes urged that the difficulty of obtaining evidence will render the proposed Act a mere dead letter. To surmount this objection there is to be a provision which will require a witness to answer incriminating questions, subject to an indemnity from the Judge who tries the case. Guarded as it will be by the condition that no action shall be taken except through the Attorney-General, we have no doubt that the new Act, even though it does not stamp out, will do much towards the extermination of the canker which infests both root and branch of our commercial system. Render a particular course of dealing criminal, and you at once place it outside the pale within which honest and straightforward commercial men must ever exercise their calling. If the Act is successfully carried through both Houses before the close of the present session, one more useful statute will have been placed upon the book.

The Thacker Coal Field of West Virginia.

By Mr. Andrew Roy, in *Mines and Minerals.*

The Thacker coal field of West Virginia is situated in Logan county, on Tug river, the stream which separates the States of Kentucky and West Virginia. The coal seam in course of development lies high in the hills, 450 to 600 feet above the level of the river, and is regarded by the West Virginia geologists as the representative of the Middle Kittaning vein of the Pennsylvania series. There is, however, considerable guesswork in attempting to identify beds of coal hundreds of miles apart. The sections look well on paper, but whether the Almighty laid down the seams that way is another question.

The Thacker coal is of excellent quality, and of good mineable thickness. It ranges from 5 to 12 feet in thickness, gaining thickness rapidly in ascending Tug river. The hills have been badly cut up by erosion, more than three-fourths of the coal area having been removed by erosive agencies in the formation of the innumerable ravines which traverse the field. One hundred and thirty feet below the Thacker vein another seam is met, known locally as the "Four-Foot Coal." In the foothills in the lower and central part of the field this coal is a homogeneous bed, but back from the river and toward the upper part of the district it splits up into two or three benches. This vein supports but one shipping mine, the output of which is not heavy, but the coal is equal, if not superior, to the Thacker. It is, however, more expensive to mine than the upper and Thacker vein, and will probably not be drawn upon heavily until the upper coal exhibits signs of exhaustion.

The companies operating the Thacker vein are five in number, and produce an aggregate product of nearly half a million tons of coal annually. The companies are: The Grape Vine Coal and Coke Company, the Lick Fork Coal and Coke Company, the Thacker Coal and Coke Company, the Logan Consolidated Coal and Coke Company, and the Lynn Coal and Coke Company. Although these concerns are called coal and coke companies, no coke is made in this field; nevertheless, the coal possesses good coking properties. One or two trials were made to manufacture coke four years ago, when the mines were first opened, but the results were not satisfactory, owing probably to the lack of experience, and no further attention has been given to the matter. The Pocahontas coal, which is *par excellence* a coking coal, can manufacture a better grade at a lower price than the Thacker operators could produce; and as both fields are on the line of the Norfolk and Western Railroad, and freight rates are practically the same, it is highly probable that no future attempts will be made to produce coke from the Thacker coal.

The width of the Thacker field, that is, the area holding the vein in course of development, is only a few miles; but along the line of strike the vein can be readily traced to the Guyandotte river and thence to New river in West Virginia. In descending Tug river from the village of Thacker the vein loses height, and becomes too thin to mine, while in ascending the river it gradually increases in volume until at the Grape Creek mines it measures 12 feet. A mile above Grape Creek the coal overshoots the hills and is lost in space.

The vein is divided into breast coal and bench coal by a parting of fireclay and only the breast coal, ranging from 3 feet to 7 feet is mined. The bench coal, which is of equal value and purity to the breast coal, possesses two, sometimes three, layers of shale, or fireclay, which is difficult and tedious to clean, or separate from the coal, and rather than run the risk of injuring the character of the coal in market, the bench coal is discarded altogether. This is all wrong, and ought not be permitted by law. The field is a limited one; but even if it were twenty times larger, no coal company should have the right to leave unwrought in the mine, beyond the possible hope of recovery, fully 3,000 tons to the acre of as good bituminous coal as is found in the United States, in every acre of domain mined over. It is a wanton waste of mineral treasure and is an injustice to posterity to permit such waste.

All the companies in the region, with the exception of the Grape Vine Coal and Coke Company, leave the bench coal untouched. This company cuts down the whole height of seam, which at their mines is 12 feet in height, the breast coal alone being between 7 and 8 feet. The impurities in the bench coal are carefully sorted out, and the product of the whole seam finds ready sale with the best grades of the breast coal mines.

All the mains are reached by inclined planes, 700 to 1,000 feet in length, and pitching 25° to 35°. At the mines of the Maritime Company coal cutting machinery has been introduced, but at all the other mines of the district pick mining still obtains. The coal is well adapted to pick mining, the undercutting or "bearing in" being tender. Electric haulage is applied at the Maritime and Thacker mines. In the former mines locomotives are used; in the latter the tail rope system is used. The front hills, in which most of the workings are still located, generally consist of long, narrow spurs, which resemble a razor-backed hog. The butt entries of the mines are seldom more than 1,000 feet in length in consequence, but nearly all the pillar coal is won, being attacked as soon as the rooms are finished. If a squeeze overruns the mines it is not an expensive matter to reopen at the head of the old workings; and at the Maritime mines 5 or 6 of these new openings have been made in this manner. At the Grape Creek mines the main entry is only 550 feet in length, from daylight to daylight.

At the mines of the Thacker Coal and Coke Company, excellent arrangements are made for the accomodation of the miners at the foot of the "incline," where the power house of the electric plant is situated. A commodious bath-house has been built in which a score or more of water jets are provided and so arranged as to discharge either cold or warm water as required. A long side room with 200 closets built in it for holding the workmen's clothes is attached to the bathroom, each closet being provided with a lock and key. The miner keeps his dress suit in his own closet while at work in the mine. After bathing in the evening he dons this suit and places his mining garb in the closet and emerges from the bathroom as "clean as a new pin," and looking more like a congressman or a state governor than a son of subterranean toil.

On the west side of Tug river, which is in the State of Kentucky, the strata are duplicated. The hills are the same height, and have been subjected to the same erosive agencies, as on the east side of the river. But there are no mines in operation on this side owing to the expense required to bridge the river. The Norfolk and Western Railway Company, having no competitors for trade in the Thacker field, require the coal companies to build their switches, and whoever crosses the Tug to operate in the Thacker vein will have to bridge the river at his own expense.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

At the annual meeting of the Windsor (Ontario) Gas Company the following officers were elected: Directors, Jerome Croul, J. T. Lynn, J. J. Leggatt and F. R. King; President, Jerome Croul; Vice-President and Treasurer, Isaac C. Baxter; Secretary, J. J. Leggatt; Manager, J. T. Lynn.

The Stacey Manufacturing Company, of Cincinnati, Ohio, has been awarded a contract for the construction of the 500,000 cu. ft. gasholder for the new plant of the Consumers Gas Company, Johnstown, Pa.

The Rome (N. Y.) Brass and Copper Company has placed an order for the steel buildings for a large brass plant with the Berlin Iron Bridge Company, of East Berlin, Conn. The contract calls for a boiler and engine house, 40 ft. wide and 120 ft. long; a casting shop, 50 ft. wide and 90 ft. long; and a tube mill, 120 ft. wide and 200 ft. long. The framework of all of these buildings is to be of steel. The roofs are to have a flat pitch, covered with tar and gravel, and the sides are arranged with a quantity of glass supported on steel framework. The building is modern in arrangement and construction, and will be absolutely fireproof.

MR. THOMAS J. HAYWARD, of the firm of Bartlett, Hayward & Co., sails for Europe next Tuesday, going on the "Kaiser Wilhelm der Grosse." He expects to return in about two months.

THE Roth Gas Engine Company has been incorporated in Indianapolis, Ind., with a capital of $50,000. The Directors are Messrs. B. F. Hough, C. C. Roth, C. E. Barrett, G W. Roth and C. F. H. Waterman.

PRESS despatches from Indianapolis, Ind., dated the 30th ult., state that Mr. Willis S. Batchley, State Geologist of Indiana, says there is no doubt that natural gas is going out in Indiana. His judgment is endorsed by the Indianapolis Natural Gas Company, the Indianapolis Trust Gas Company, and the Logansport and Wabash Valley Gas Company, the three concerns, controlling the gas field, which have just served notice to the public that they will not take on any new consumers. Experts declare that the entrance of two new great pipe line companies, one to supply gas to Chicago and the other to draw upon the field for Ohio consumption, means the beginning of the end. The State Geologist thinks that when the history of natural gas in Indiana is written, the story will be the same as that of the Pennsylvania gas fields, which yielded a bountiful flow for a period and then dwindled down to a scant supply. Factories which had built up great industries in the Keystone State left it when gas was discovered in Indiana, and the effect of the location of factories in the gas belt in Indiana is told by the cities which have sprung from county seat towns. Anderson, Muncie, Elwood, Marion and other cities before the gas boom were good sized towns, but they are now centers of various manufacturing industries and the products from their shops go all over the United States and abroad. Mr. Blatchley thinks there should have been a law to prohibit the piping of gas from the State, but it is now too late to talk of such a measure, and the attention of the people should be turned to the question of how Indiana is going to keep her factories when the gas gives out. There is no need of immediate alarm over the prospect, Mr. Batchley thinks, for he says natural gas for factory fuel, with proper use, will continue to flow for two or three years, and for private use it should continue for five years or longer. Solution of the question of how to keep factories from leaving Indiana, Mr. Blatchley thinks, is to be found in the extensive coal fields of the State.

THE Legislature of Florida is considering a bill which proposes "to enable the city of Tallahasse to manufacture and distribute gas and electricity, and to construct, purchase, lease, establish and maintain within its limits one or more plants for the manufacture and distribution of gas and electricity, for furnishing lights for municipal use, and for the use of such of its inhabitants as may require and pay for the same."

A CORRESPONDENT in Minneapolis forwards the following: "The proprietors of the Eau Claire (Wis.) Gas Light Company are overhauling and extending its main system. Some days ago, while replacing a main at a point on Grand avenue near South Borstern street, the workmen discovered a bundle of papers in the old main, which discovery explained why it was that consumers in that vicinity often complained of scanty gas supply. Next summer the Company will construct a storage holder on the site recently secured at the confluence of the Eau Claire and Chippewa rivers, and the year after (1901) a complete new works will be erected. The Company's business is growing at a rate that is really wonderful."

THE proprietors of the Hollister (Cal.) Light and Power Company have virtually determined to change the generating system from coal lines to a water gas basis.

ON the 29th ult. the various gas and electric properties of Bergen county, N. J., that have from time to time been acquired by the proprietors of the Hackensack Gas and Electric Company, were consolidated under the title of the Gas and Electric Company of Bergen county. The bonded indebtedness is $1,500,000 and the capital stock is $2,000,000. The officers are: Directors, Frank B. Poor, George W. Conklin, David St. John, E. A. Pearce, Lemuel Lozier, W. C. Thomas and Samuel Taylor, of Hackensack; E. A. Walton, of Ridgewood; Addison Ely and William McKenzie, of Rutherford; Hamilton F. Kean, of Elizabeth; T. N. McCarter, of Newark; and Arthur B. Sturges, of New York. The plants will be operated from Hackensack and the Company proposes to spare neither expense nor thought in keeping up its plants so that consumers will be served completely and well.

THE Newport News (Va.) Gas Company is making many main extensions, notably in the district known as the North End, which tract is controlled by the Old Dominion Land Company. The Company is also considering the advisability of putting in a coal gas plant.

AT a special meeting of the shareholders in the Norristown (Pa.) Gas Company, held May 27th, it was decided to lease their property and franchises, for a term of 60 years, to the Gas Company of Montgomery County. We also understand that hereafter the gas rate in Norristown is to be $1 per 1,000 cubic feet. a concession of 30 cents per 1,000.

The Troy Gas Company, of Troy, N. Y., has purchased three lots on River street, adjoining its electric lighting plant, on the south.

A CORRESPONDENT in Denver, Col., in forwarding to us a note reporting the incorporation of the Independence Mining Company, of Cripple Creek, Col., remarks, and quite truthfully, that some of the objects of the Company are wonderful, and a few of them are: "To manufacture, sell and supply light in any part of the world, and to carry on business of gas works; to deal with and manufacture and render saleable coke, coal tar, pitch, asphaltum, ammoniacal liquor and residual products obtained in the manufacture of gas; to manufacture, buy, sell, let or hire and deal in stoves and engines; to do a general banking business in all its branches; to guarantee title to or quiet enjoyment of property," etc.

THE works of the Portsmouth (O.) Gas and Electric Company are to be rebuilt.

AT a meeting of the Detroit (Mich.) Gas Company, held the last week in May, it was voted to lay 35 miles of mains.

THE Logan Iron Works, Brooklyn, N. Y., has accepted contracts which call for the construction, on the property of the Green Bay (Wis.) Light, Heat and Power Company, of a storage holder to rest in a steel tank, a large oil tank, and a complete set of water gas generating apparatus.

THE Directors of the Morristown (N. J.) Gas Light Company have announced a new selling schedule. Under it gas used for illuminating will be charged at $1.65 per 1,000 cubic feet—a concession of 20 cents per 1,000; for cooking, heating and power supply, the rate is to be $1.45 per 1,000—a concession of 25 cents per 1,000.

THE vietors in the voting contest, which election was held in connection with the course of demonstration lectures on cooking by gas recently given by the Pensacola (Fla.) Gas Company, were: First prize (an 18-inch oven gas range), Mrs. J. F. Boyesen; second prize (a 3-hole hot plate), Mrs. F. R. Piaggio; third prize (a 3 compartment steam cooker) Mr. S. A. Moreno.

THE franchise of the Dansville (N. Y.) Gas and Electric Lighting Company has been extended for a term of 20 years. The agreement provides that no other company may transact business on gas or electric account, while the existing company "furnishes light as cheap and as good as that furnished to other towns of this size."

THE proprietors of the Meriden (Conn.) Gas Light Company are making the following offers to the residents:

"We will pipe and fixture, below cost, old houses along our lines of mains, as follows:

3	rooms in house or flat, leaving gas stove opening in kitchen							$9
4	"	"	"	"	"	"	"	11
5	"	"	"	"	"	"	"	13
6	"	"	"	"	"	"	"	15
7	"	"	"	"	"	"	"	17
8	"	"	"	"	"	"	"	19

"Call and see the fixtures. A postal will bring a man with photographs. We have a better grade of fixtures for $4 more per set." Superintendent Learned's work so far this year in securing orders for gas cookers has been quite satisfactory to the Company and to himself.

MR. E. C. HATHAWAY, formerly in charge of the works' end of the Charlotte (N. C.) Consolidated Construction Company, has been appointed General Manager of the consolidated gas and electric lighting

(*Continued on page* 856.)

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

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AGENTS:

New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, JUNE 5, 1899.

(*Continued from page* 855.)

interests of Lexington, Ky. The Lexington properties were recently purchased by Messrs. John L. Williams & Sons, of Richmond, Va.

MR. JOHN COLLINS, Supt. of the Port Jervis (N. Y.) Gas Company is busily engaged in relaying and extending its main system. The demand for gas on cooking account steadily increases.

AT the annual meeting of the shareholders in the Consumers Gas Company, Reading, Pa., the Directors chosen were: Samuel T. Bodine, Wayne MacVeagh, Edward C. Lee, R. L. Jones and L. T. Custer.

THE Burlington (Ia.) *Journal* is our authority for the statement that the plant and franchises of the Burlington Gas Light Company have been purchased by the Burlington Railway and Light Company.

THE proprietors of the Newport (Ky.) Light Company offered the authorities $150 per annum, for the period of 10 years, for the privilege of laying and maintaining a gas main along the Newport and Covington bridge. The authorities demanded $250 per annum for the right, which sum the Company declined to pay. Another proposition will be submitted by the Company some time this month.

THE Tennessee Coal, Coke and By-Product Company will erect this summer a coke oven plant at Harriman, Tenn.

COMMISSIONERS DRAKE and Healy, of the Buffalo (N.Y.) Board of Public Works, have asked for proposals for a site for a municipal gas plant. It is stipulated that all proposals must be accompanied by a certified check, that each site offered must approximate 40,000 yards square in area and must accommodate a gas plant in accordance with the plans now on file in the office of the Board—land contiguous to railroad lines and water frontage will be given the preference. The competition will close at 11 A. M. of June 9th.

THE Hendry Machine Company, of Torrington, Conn., is building a new engine room, 40 feet wide and 60 feet long. The side walls are of brick, and the roof has steel trusses with corrugated iron covering, supported on steel purlins. A large ventilator, extends along the ridge of the roof. The Berlin Iron Bridge Company is furnishing and erecting the steel framework and covering.

THE *American Engineer* says that gasoline engines have been selected as the most satisfactory force of power for removing the water of drainage from the depressed track work at 16th and Clark streets in Chicago. The height of the Chicago river varies in such a way as to necessitate pumping the water when at the high levels and yet most of the time natural drainage may be relied upon. The drainage is all directed toward a sump, immediately over which two 8-horse power Fairbanks Morse gasoline engine are placed and coupled to centrifugal pumps, which are immersed in the sump. These pumps have a capacity of 2,250 gallons per minute and they are coupled direct to the engines by clutches, which may be thrown into gear after the engines are started. The application of gasoline engines to this service is admirable, because the demand is intermittent. The river is often low enough for several weeks at a time to permit of gravity drainage, and yet the pumping machinery must be ready for instant use when required. This requirement, as well as low cost of operation and small initial outlay required, seemed to be best fulfilled by the gasoline engine.

Aluminum Feed Wires.

The Pittsburg Reduction Company has received an order from the Chicago Northwestern Elevated Railway Company for 150,000 pounds of aluminum to be used as feed wires on that road.

This will be the first electric road in the country that has attempted the use of aluminum for feed wires.

Three sizes of aluminum cable will be used. The largest feeder is about 1⅛ inches in diameter, and the railroad company is buying over 10 miles each of the two larger sizes.

The feeders will be placed in a wooden box, or trough, covered by the board walk between the tracks of the elevated. They will be supported on vitrified clay blocks, about 9 feet apart, and designed with an umbrella drip.

Every 100 feet a special malleable iron chair will be used, the cable being carried in split spool insulators to hold the slack.

Experiments have been made by J. R. Chapman, Chief Engineer of the Northwestern.

It is estimated that 47 pounds of aluminum wire will answer the same purposes of a 100 pounds of copper wire, while the difference in cost, considering the equal conductivity, will make the aluminum cheaper. The copper costs about 20 cents a pound, while the aluminum can be had for about 36 cents a pound. The installation in Chicago was caused by the rising price of copper and the success of the aluminum lines at Niagara Falls and at Snoqualmie Falls on the Pacific coast.

The Market for Gas Securities.

Consolidated sold down to 165 during the week, plus dividend, and closed to-day (Friday) at 170 to 170½ ex dividend. Since yesterday persistent rumor is to the effect that a basis of settlement has been reached, but rumor has been so far short of realization recently that shareholders might better wait and watch than act. Meanwhile it might help the good cause if they prayed occasionally that the executives of the different companies should make no further erratic moves. The New Amsterdam specialties are dull and weak, and a like verdict applies to Standards.

Brooklyn Union closed at 130 to 140; Peoples, of Chicago, is recovering rapidly from the recent depression in it; Bay State still declines, the figure to-day being 2¼ to 2½. Washington gas is 250 bid. Cincinnati gas still shows weakness, but it looks a purchase, for the likelihood is that no opposition franchise will be granted, although on the other hand there is much evidence to support the assertion that the existing Company will put its selling rate at 80 cents per 1,000.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

JUNE 5.

☞ All communications will receive particular attention

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$39,078,000	100	170	170½
Central Union, Bonds, 5's.	3,000,000	1,000	107⅛	108½
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	115	118
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	300	320
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	
New Amsterdam Gas Co.	13,000,000	100	31¼	32¼
Preferred	10,000,000	100	55⅛	56
Bonds, 5's	11,000,000	1,000	100⅛	101
Northern Union, Bonds, 5's.	1,250,000	1,000	95	97
New York and East River..				
Bonds 1st 5's	3,500,000	1,000	109	111
" 1st Con. 5's	1,500,000	..	112	114
Richmond Co., S. I.	348,650	50	70	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	110	120
Preferred	5,000,000	100	125	137
Bonds, 1st Mortgage, 5's	1,500,000	1,000	112	114
Yonkers	299,65	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	130	140
" " Bonds (5's)	15 000,000	1,000	118	119
Bay State	50,000,000	50	2¼	2⅜
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works.	450,000	100	40	..
" 1st Mtg. 5's	450,000	1,000	95	98
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	92	..
2d " " "	3,000,000	1,000	68	71
Buffalo City Gas Co.	5,500,000	100	12	14
" " Bonds, 5's	5,250,000	1,000	89	91
Central, San Francisco	2,000,000	..	105	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Columbus	1,144,700	100	70	75
1st Mortgage	1,207,000	1,000	106	108

Consumers. Jersey City	2,000,000	100	95	.
" Bonds	600,000	1,000	107½	110
Cincinnati G. & C. Co.	8,500,000	100	186	187
Consumers, Toronto	1,700,000	50	240	235
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	
Consolidated, Baltimore	11,000,000	100	..	63
Mortgage, 6's	3,600,000		..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	23	25
" Con. Mtg. 5's	380,000	1,000	80	82
Consolidated G. & E. Co.'s, Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,560,000	50	65	65½
" Prior Lien 5's	4,546,000	1,000	94¼	94½
Detroit Gas Co., 5's	423,000	1,000	95½	96
" Inc. 5's	81,000	100	.	..
quitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	62	65
" Bonds	2,000,000	..	80	85
Grand Rapids Gas Lt. Co.	1,000,000	50	..	..
" 1st Mtg. 5's	1,125,000	1,000	..	.
Hartford	750,000	25	..	145
Indianapolis	2,000,000	..	122	128
" Bonds, 6's	2 650,000	..	105	106
Jackson Gas Co	250,000	50	..	..
" 1st Mtg. 5's	250,000	1,000	..	..
Jersey City	750,000	20	225	275
Lafayette Gas Co., Ind	1,000,000	100	68	70
Bonds	1,000.000	1,000	81	86
Louisville	3,570,000	50	106	108
Laclede, St. Louis	7,500,000	100	52½	52¾
Preferred	2,500,000	100	99½	101
Bonds	10.000,000	1,000	107	108
Madison Gas & Elec. Co.	400,000	100	68	70
" 1st Mtg. 6's	350,000	1,000	102	..
Montreal, Canada	2,000,000	100	300	..
Newark, N. J., Gas Co	1,000,000	..	200	220
Bonds, 6's	4,000,000	.	128	130x
New Haven	1,000,000	25	280	300
Nashville Gas Lt. Co.	1,000,000	50	110	..
Oakland, Cal.	2,000,000	..	53½	55
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25.000.000	100	116¼	116⅜
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	111½	112
2d "	2,500.000	1,000	104	105
Peoples, Jersey City	500,000	50	215	..
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10.000,000	100	74	75
St. Paul Gas Light Co	1,500,000	100	50	52
1st Mortgage 6's	650,000	1,000	82	85
Extension, 6's	600,000	1.000	..	..
General Mortgage, 5's	2,428,000	1,000	80	82
St. Joseph Gas Co	1,000,000	100	..	..
" 1st Mtg. 5's	750,000	1,000	.	..
Syracuse, N. Y.	1,750.000	100	16	19
Bonds	1,612 000	1,000	85	89
Washington, D. C	2,600,000	20	250	..
First mortgage 6's	6 0,000		..	..
Western, Milwaukee	4,000.000	100	97	97¾
Bonds, 5's	3,880,500	.	106	108
Wilmington, Del	550.000		208	..

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1251-4 care this Journal.

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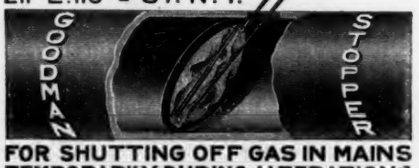
315 Fidelity Building, 112 N. Broad St., Phila.

SAFETY GAS MAIN STOPPER CO.

211-E. 116 TH ST. N.Y.



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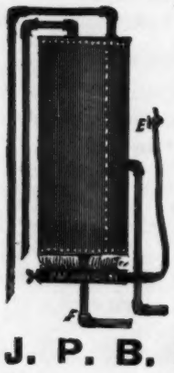

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BUFFALO CITY GAS CO., BUFFALO, N.Y., April 1, 1899.
J. P. B. SADTLER & Co., 813 S. Howard St., Baltimore, Md.
Gentlemen—Replying to your favor of the 30th of March. The Heller Heaters that you have already furnished seem to be large enough, and we will not at present care to use any of the larger size that you mention. We have had no complaint in regard to the Heller Heater that we have used in Buffalo, and so far they are giving us good satisfaction.
Yours very truly, E. H. JENKINS, Engineer.

BALTIMORE, MD., March 24, 1899.
J. P. B. SADTLER & Co., 813 S. Howard St., Baltimore, Md.
Gentlemen—A test of the Heller Water Heater witnessed by me March 21, 1899, showed that with a consumption of 30 feet of gas per hour, the water in a 28 gallon galvanized boiler could be heated from 59° to 102°, or 43° in one hour. Temperature of room at time of test 64°.
Respecfully,
GEO. BEADENKOPP, Ass't Engineer, Con. Gas Co.

Clamp Heater to Pipe about 4 Inches away from bottom of Boiler. Always use an independent connection, or regular Gas Stove connection, so as to get a good flow of Gas.

J. P. B. SADTLER & CO., 813 South Howard Street, Baltimore, Md.

W. H. PEARSON, Prest. W. H. PEARSON, Jr., Vice-Prest. J. T. WESTCOTT, M.E., Manager. L. L. MERRIFIELD, M.Inst.M.E., Chief Engineer.

THE ECONOMICAL GAS APPARATUS CONSTRUCTION CO., LD.

American Offices: 269 FRONT STREET, EAST, TORONTO, ONT.
London Offices: 19 ABINGDON STREET, WESTMINSTER, S.W.

Telegraphic Address: "CARBURETED LONDON AND TORONTO."

The above Company have erected since 1893, or are now erecting, their universal type of Carbureted Water Gas Plants at the following Gas Works:

	Cubic Feet Daily.
Blackburn, Eng.	1,250,000
Windsor Street Works, Birmingham, Eng.	2,000,000
Saltley Works, Birmingham, Eng.	2,000,000
Colchester, Eng.	300,000
Birkenhead, Eng.	2,250,000
Swindon (New Swindon Gas Co.), Eng.	120,000
Saltley Works, Birmingham, Eng. (2d Contract)	2,000,000
Windsor St. W'ks, Birming'm, Eng. (2d Contract)	2,000,000
Halifax, Eng.	1,000,000
Toronto,	250,000
Ottawa,	250,000
Toronto (Second Contract, Remodeled),	2,000,000
Lindsay (Remodeled),	125,000
Belleville,	250,000
Ottawa (Second Contract),	250,000
Brantford (Remodeled)	200,000
St. Catherine's (Remodeled),	250,000
Kingston, Pa.	125,000
Montreal,	500,000
Peterborough, Ont.	250,000
Wilkesbarre, Pa.	750,000
St. Catherine's (Second Contract),	250,000
Buffalo, N. Y.	2,000,000
Winnipeg, Man.	500,000
Colchester, Eng. (Second Contract),	300,000
York, Eng.	750,000
Rochester, Eng.	500,000
Kingston, Ont.	300,000
Crystal Palace District, Eng.	2,000,000
Duluth, Minn.	300,000
Caterham, Eng.	150,000
Leicester, Eng.	2,000,000

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Street and Boulevard
Lamps.
Cheapest and Best.
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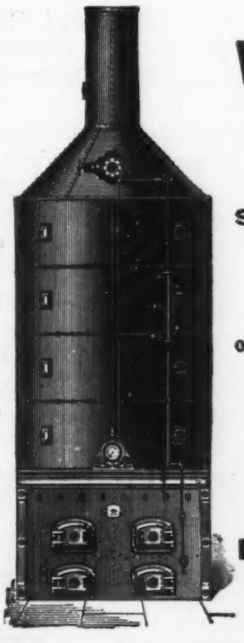
Send for Catalogues.
THOMAS T. W. MINER,
821-823 Eagle Av., N. Y.

GEORGE R. ROWLAND.
Formerly with the Continental Iron Works.
Draughtsman and Constructing Engineer.
Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.
Office, No. 245 Broadway, N. Y. City.

The Gas Engineer's
Laboratory Handbook.
By JOHN HORNBY, F.I.C.
Price, $2.50.
A. M. CALLENDER & CO., 32 Pine Street, N.Y. City.



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WATER-TUBE BOILERS.
THE HAZELTON OR PORCUPINE BOILER
IN 50 to 500 H. P. UNITS.
SINGLE BOILERS OR COMPACT BATTERIES.
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GAS STEAM TABLES,
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GRAY IRON CASTINGS.

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GAS LAUNDRY STOVES,
GAS OVENS,
GAS PLATE WARMERS,
GAS OYSTER STEWERS,
GAS CONTROLLERS,
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GAS FIRES,
GAS RADIATORS,
GAS LOGS,
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THE NEW VULCAN GAS RANGE.

Sizes, 16 and 18-inch Ovens.

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Special Trays for Iron Sponge or Oxide of Iron,

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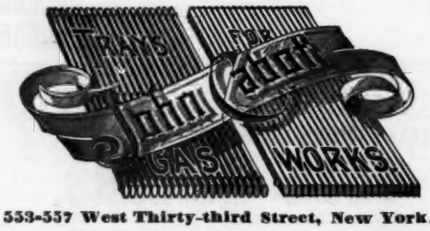
Reversible, Strongest, Most Durable, Most Easily Repaired



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REVERSIBLE BOLTED TRAYS IN THE MARKET.
Send for Circulars.

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HUMPHREYS & GLASGOW,

BANK OF COMMERCE BLDG., 31 Nassau Street, New York.

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CONSULTING GAS ENGINEERS
AND MANAGERS.
GAS PROPERTIES PURCHASED.

Bristol's Recording
PRESSURE GAUGE.
For continuous records of **Street Gas Pressure.**
Simple in construction, accurate in operation, and low in price.
Fully Guaranteed. Send for Circulars.

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Valves and Gates for Gas, Ammonia, Water, Etc.

Also, Gate Fire Hydrants with and without Independent Nozzle Valve. All Work Guaranteed.

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Chicago Office, 24 West Lake St. New York Office, 28 Platt St.
St. Louis Office, L. M. Rumsey Mfg. Co., 810 North Second St.

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Double and Single Gate Valves, ¼" to 72",

—FOR—

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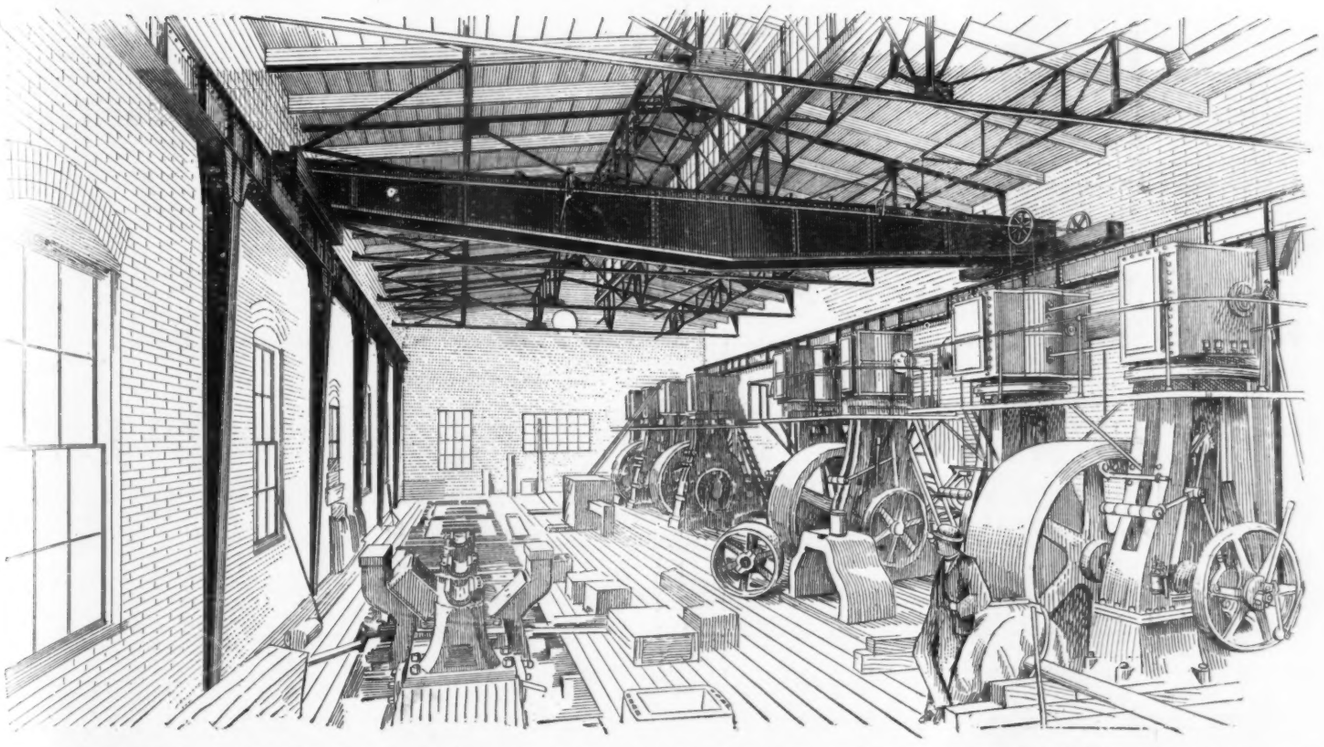
Engineers, Architects and Builders of Steel Structures.



The above illustration is taken direct from a photograph and shows the interior of Power House designed and built by us for the Worcester Traction Company, at Worcester, Mass. The building is 47 feet wide and 120 feet long, with a traveling crane as shown. The roof being very flat, it is covered with plank, tar and gravel. The entire framework is of steel, a light brick wall being placed between the posts to protect the interior of the building from the weather.

BOSTON OFFICE, 200 Equitable Building.
NEW YORK OFFICE, 718 Bennet Building, Cor. Fulton and Nassau Streets.

Main Office and Works, EAST BERLIN, CONN.

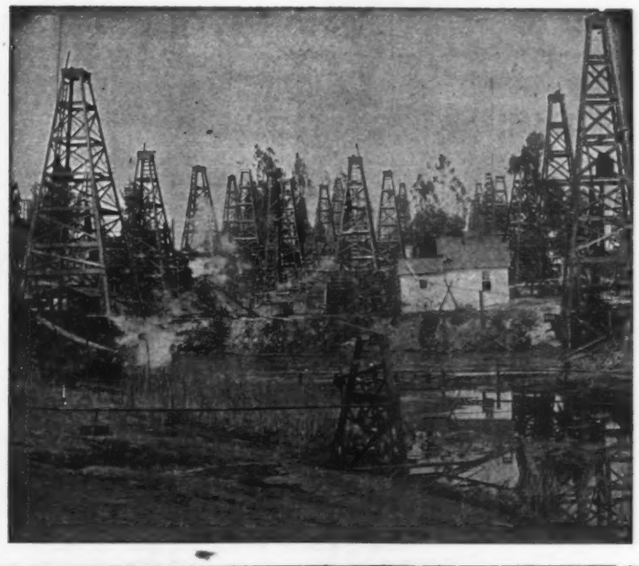
Gas Investments in California.

Nowhere else on this continent does such opportunity exist for profitable gas investment as on the Pacific Coast, since the perfection of the new LOWE Process for using the heavy crude California oils (of which there is an unlimited supply) without the use of any other fuels. Seven years' test proves the system to be perfect in every respect. Los Angeles alone, in addition to present street mains, has 150 miles of well built up streets without a gas main on them. To occupy this territory, and a large number of other towns now without gas, we have organized a parent company and a number of local companies covering some of the fastest growing cities in the United States.

Now is the time to invest, when the first capital will be able to double itself in a single year. This is also the most delightful residence section in the United States.

We suggest to those desiring gas investments, in large or moderate amounts—with or without active business connections—to come here and investigate; or, what is the next best thing, write us for particulars and prospectus.

The accompanying cut shows the oil wells in the suburbs of Los Angeles from which the Companies under the NEW LOWE GAS PROCESS obtain their supply of oil.



AMERICAN GAS & COKE CO. (T. S. C. Lowe, Manager),
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Mr. T. Viner Clarke, of London, Eng., having compiled a novel Chart or Map illustrating the various CHEMICAL PRODUCTS DERIVED FROM COAL AND COAL TAR, in the form of a Genealogical Tree, including all the products discovered (the total number amounting to near 700), offers for sale a limited number of copies in Colors, mounted on Linen, with Rollers. Price, $3.50. Orders may be sent to **A. M. CALLENDER & CO., 32 Pine Street, New York City.**

AMERICAN GAS COMPANY

Constructors of Coal Gas Apparatus.

KLONNE-BREDEL

Recuperative Furnaces, Washers, Condensers, Purifiers and Purifying Machines, Ammonia Plant, Coke Conveyers, Etc.

Complete Works Erected with Guaranteed Results.

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P. H. & F. M. ROOTS CO.'S
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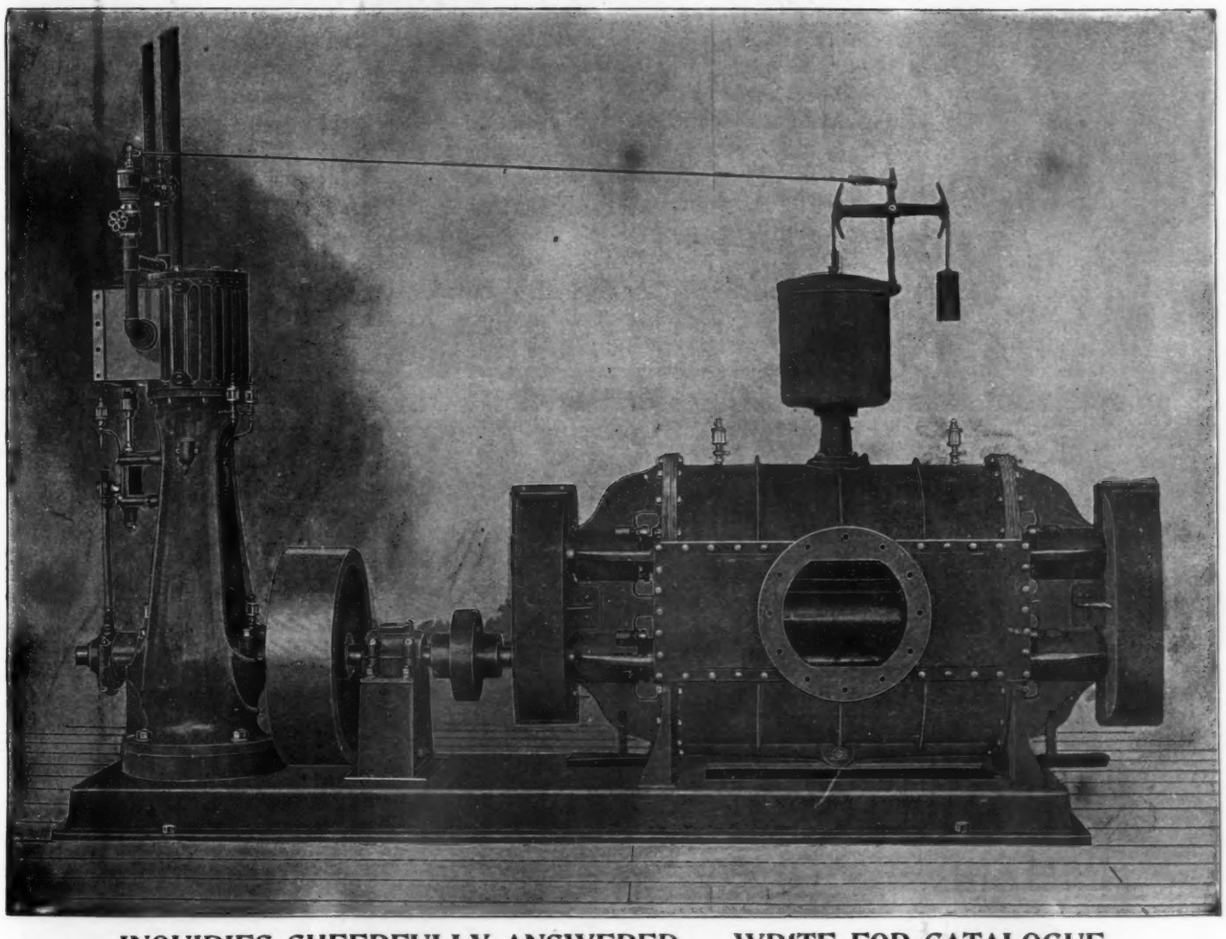

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——OWNS, CONTROLS AND OPERATES——

EXCLUSIVELY

THE NEW IMPROVED AND PATENTED STREET LIGHT BURNER.

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Our PATENTED "STREET LIGHT APPLIANCES" have made WELSBACH STREET LIGHTING a complete success.

By the UNIFORM DISTRIBUTION of light on scientific principles a greater area can be lighted by our system and more economically than in any other way.

Where there are no gas mains already laid, we can furnish an equally good light by our **SELF-GENERATING NAPHTHA WELSBACH BURNER,** enabling Gas Companies to furnish a uniform light in all localities.

Lists of Cities and Towns in which we are now lighting under contract will be furnished upon application.

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CORRESPONDENCE SOLICITED FROM GAS COMPANIES AND OTHERS INTERESTED IN MUNICIPAL LIGHTING.

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This Edition of the "Handbook for Gas Engineers and Managers" is a great improvement on all previous editions Much of the text has been re-written, in order to keep the work abreast of the constant advances that are being made in the Gas Industry.

PRICE, - - $6.00.

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PRACTICAL HANDBOOK ON

GAS ENGINES

With Instructions for Care and Working of the Same.

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Translated with Permission of the author by GEO. M. RICHMOND, M.E

Price, $1.00.

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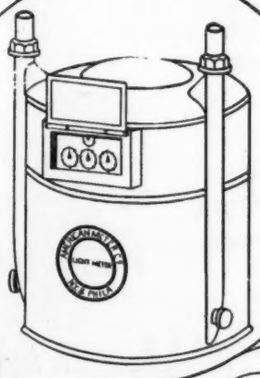

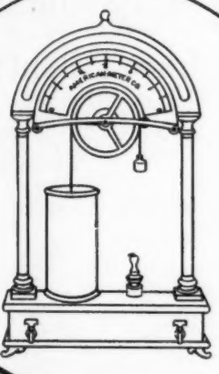

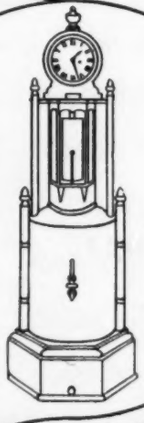

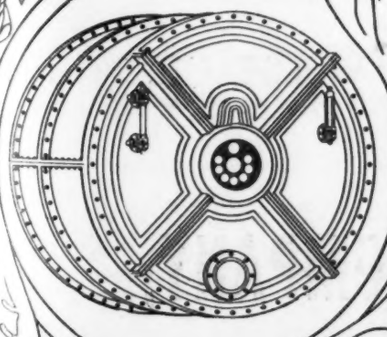

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AMERICAN METER CO.

ESTABLISHED 1834. INCORPORATED 1863.

NEW YORK AND PHILADELPHIA,

CHICAGO, ST. LOUIS,

SAN FRANCISCO.

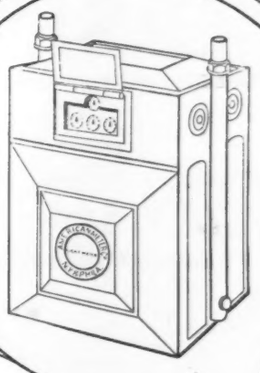
PUBLIC LIGHTING TABLE.

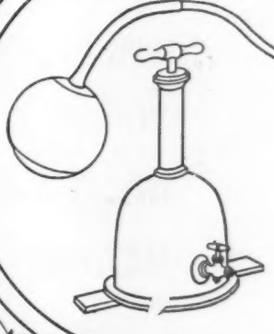
JUNE, 1899.

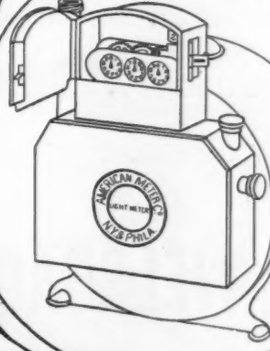
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Extingnish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Thu.	1	7.50 PM	1.50 AM	7.15	3.15
Fri.	2	7.50	2.20	7.15	3.15
Sat.	3	7.50	2.50	7.15	3.15
Sun.	4	8.00	3.30	7.25	3.15
Mon.	5	8.00	3.30	7.25	3.15
Tue.	6	8.00	3.30	7.25	3.15
Wed.	7	8.00 NM	3.30	7.25	3.15
Thu.	8	8.00	3.30	7.25	3.15
Fri.	9	8.00	3.30	7.25	3.15
Sat.	10	8.00	3.30	7.25	3.15
Sun.	11	8.00	3.30	7.25	3.15
Mon.	12	9.30	3.30	7.25	3.15
Tue.	13	9.50	3.30	7.25	3.15
Wed.	14	10.20	3.30	7.25	3.15
Thu.	15	10.40 FQ	3.30	7.25	3 15
Fri.	16	11.00	3.30	7.25	3.15
Sat.	17	11.30	3.30	7.25	3.15
Sun.	18	12.00 AM	3 30	7.30	3.15
Mon.	19	12.40	3 30	7.30	3.15
Tue.	20	1.20	3.30	7.30	3.15
Wed.	21	2.20	3.30	7.30	3.15
Thu.	22	No L.	No L.	7.30	3.15
Fri.	23	No L. FM	No L.	7.30	3.15
Sat.	24	No L.	No L.	7.30	3.15
Sun.	25	8.00 PM	10.20 PM	7.30	3.15
Mon.	26	8.00	10.50	7.30	3.15
Tue.	27	8.00	11.20	7.30	3.15
Wed.	28	8.00	11.50	7.30	3.15
Thu.	29	8.00 LQ	12.20 AM	7.30	3.15
Fri.	30	8.00	12.50	7.30	3.15

TOTAL HOURS LIGHTING DURING 1899.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	215.40	January	423.20
February	184.40	February	355.25
March	187.40	March	355.35
April	166.50	April	298.50
May	158.00	May	264.50
June	140.50	June	234.25
July	150.30	July	243.45
August	168.30	August	280.25
September	179.50	September	321.15
October	213.20	October	374.30
November	217.00	November	401.40
December	238.10	December	433.45
Total, yr.	2221.00	Total, yr.	3987.45







Welsbach Patent Again Sustained.

Following the recent decision in the United States Circuit Court of Appeals, sustaining the Welsbach Company's Patent, Judge Lacombe, in the United States Circuit Court, has enjoined the following infringers of the Welsbach Patent:

DAYLIGHT INCANDESCENT GAS LAMP CO.
REX INCANDESCENT GAS LIGHT CO.
AMERICAN INCANDESCENT LIGHT CO.
NEW YORK CHEMICAL REFINING CO.
UNION INCANDESCENT LIGHT CO.
AMERICAN LIGHTING CO.
YOUNG & FLETCHER CO.
HECKLA MANTLE WORKS, Henry Anhalzer, Prop'r.
MERIDEN-ALBERTA MANTLE CO.

You are cautioned against infringement of the Welsbach Patent, as you will be held liable for an accounting.

All genuine Welsbach Lights bear the trademark "WELSBACH," and are for sale by all first-class dealers in Gas Appliances.

WELSBACH COMMERCIAL COMPANY,

Philadelphia.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

THE STANDARD JUNIOR,

THE STANDARD DOUBLE SUPERHEATER,

LOWE WATER GAS APPARATUS.

Under Contract, 1899:

	SETS.	DAILY CAPACITY.
Fostoria, O.	1	250,000 Cubic Feet.
Derby, Conn.	1	750,000 "
Lowell, Mass.	1	1,000,000 "
Doylestown, Pa.	1	50,000 "
Darby, Pa.	1	400,000 "
Adrian, Mich.	1	125,000 "
Concord, N. H.	1	400,000 "
Sioux City, Iowa	1	750,000 "
Standard Gas Light Co., New York	3	5,400,000 "
Peekskill, N. Y.	1	250,000 "
Westchester, N. Y.	1	250,000 "
Jersey City, N. J.	1	1,000,000 "
Stapleton, N. Y.	1	750,000 "
London, O.	1	125,000 "
Total	16	11,500,000 "
Previously built	294	187,100,000 "
Grand Total	310	198,600,000 "

Established 1858. Incorporated 1890.
CHAS. E. GREGORY Prest. DAVID R. DALY V. Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

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CLAY GAS RETORTS, FIRE CLAY TILES,
FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

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E. D. WHITE, President. A. H. GUTKES, Vice-President. H. A. PERKINS, Secretary.

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Gas House and other Tile.

Office, 88 Van Dyke St. Brooklyn, N. Y

Established 1854. Incorporated 1869.

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Manufacturers of GAS RETORTS . .
FIRE BRICK . . .
RETORT SETTINGS

Water Gas Cupola Linings, Fire Clay, Etc.

Exclusive Agents for

The Mitchell Half-Depth Regenerative Furnace.

This is the *original* coal-consuming Furnace for Retort Benches. Burns either Coal or Coke. Full and Half-Depth Regenerative Furnaces for Benches of 6's, 7's, 8's or 9's erected complete.

Proprietors of the Coze System of Inclined Retorts.

Office: 901 Pine St., **St. Louis, Mo.**

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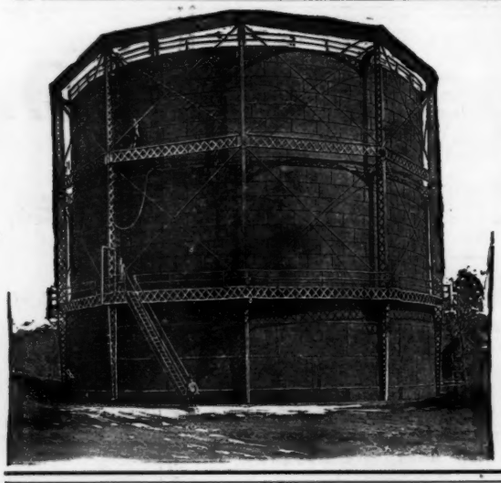

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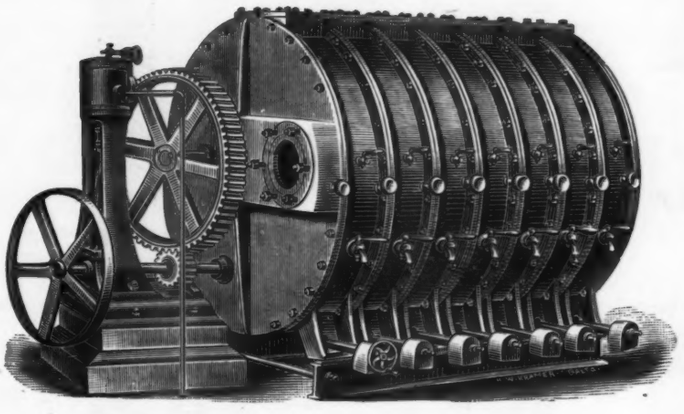

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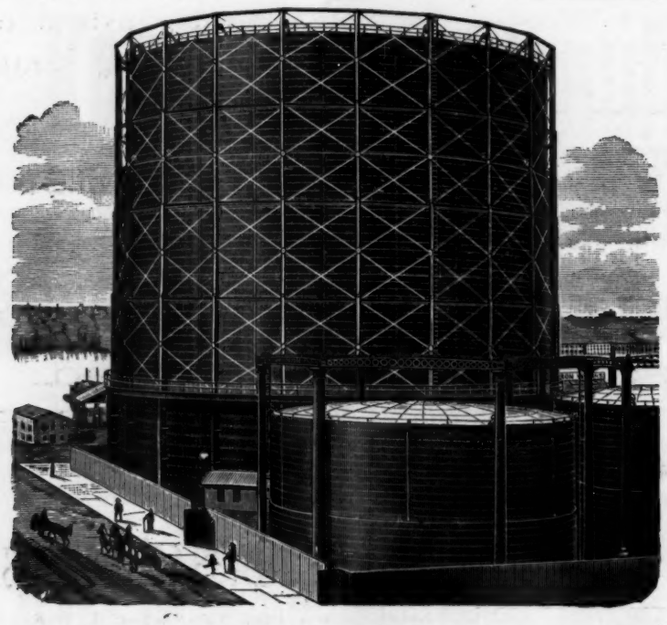

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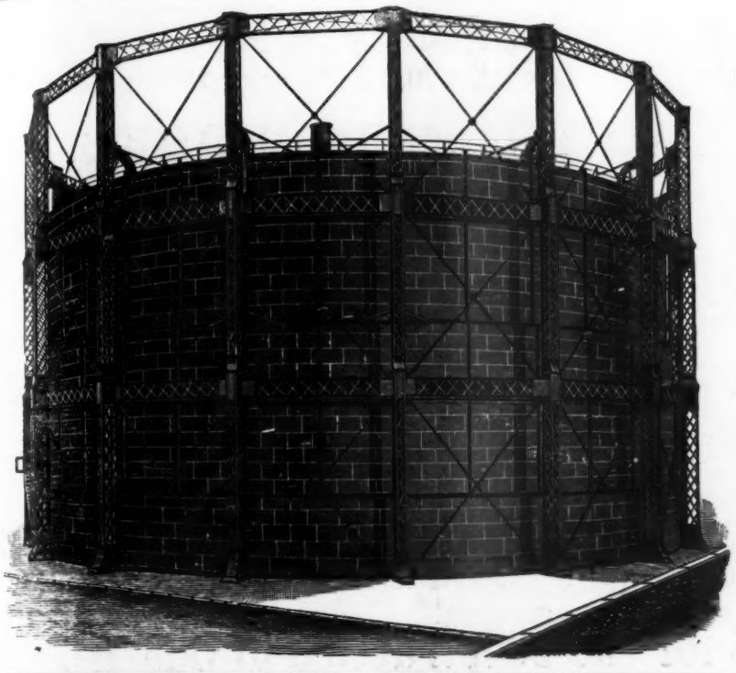

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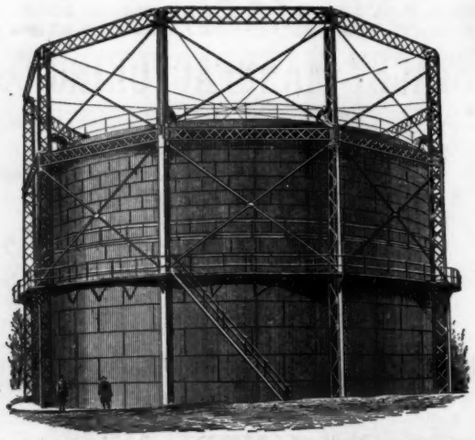

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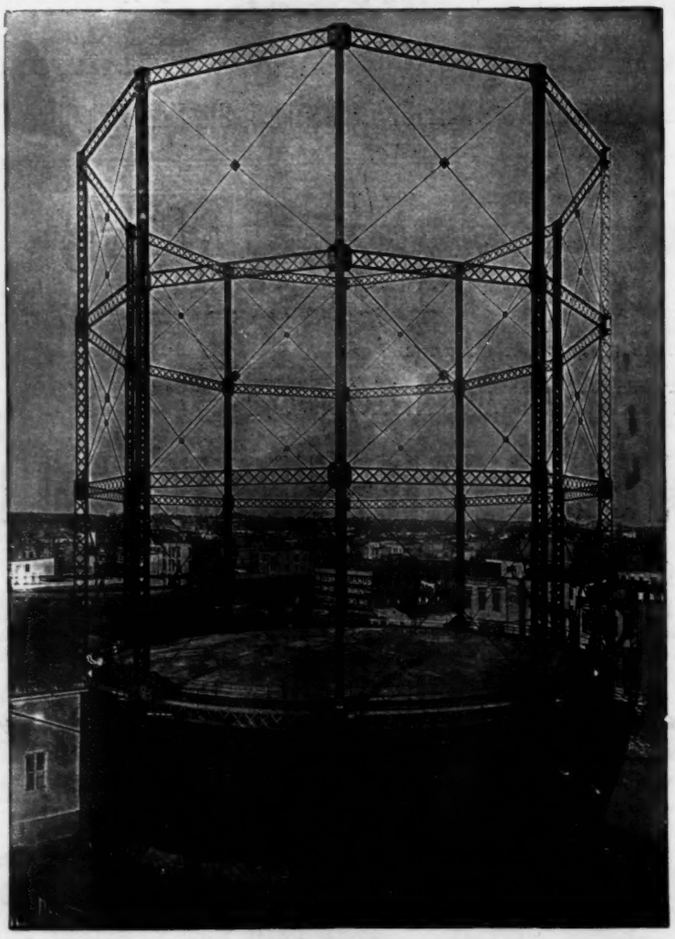

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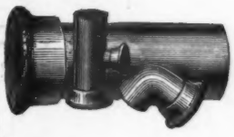

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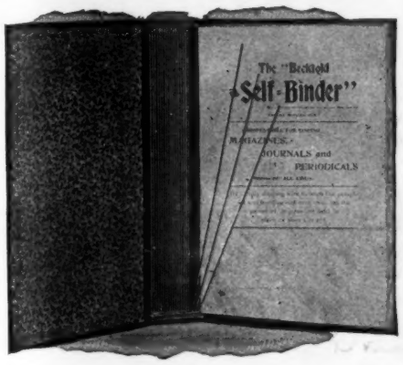

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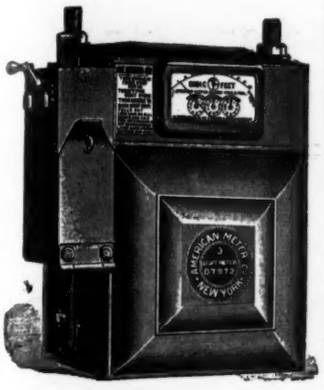

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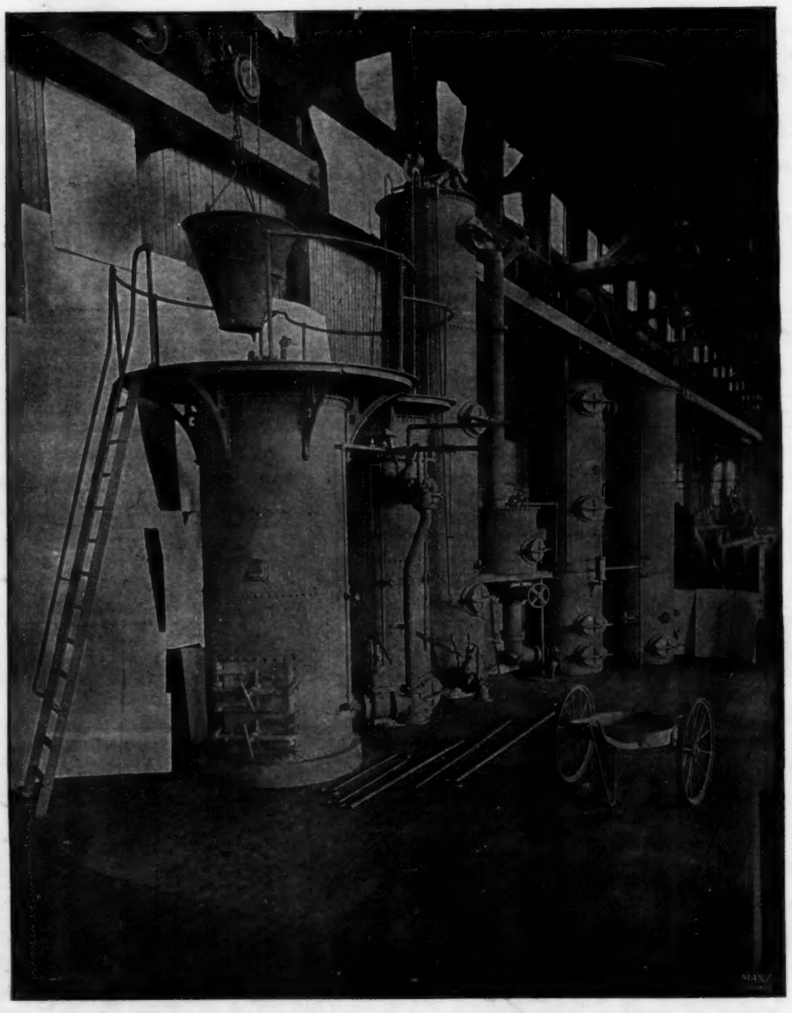

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